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REPORT NO T18-89

AN EVALUATION OF THE NUTRITIONAL INTAKE AND ACCEPTABILITY OF THE MEAL, READY-TO-EAT CONSUMED WITH AND WITHOUT A SUPPLEMENTAL PACK IN A COLD ENVIRONMENT

U S ARMY RESEARCH INSTITUTE
OF
ENVIRONMENTAL MEDICINE
Natick, Massachusetts

MAY 1989

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1a REPORT SECURITY CLASSIFICATION: N/A	1b RESTRICTIVE MARKINGS:
2a SECURITY CLASSIFICATION AUTHORITY: N/A	3 DISTRIBUTION/AVAILABILITY OF REPORT: Approved for public release; distribution unlimited.
2b DECLASSIFICATION/DOWNGRADING SCHEDULE: N/A	
4 PERFORMING ORGANIZATION REPORT NUMBER(S):	5 MONITORING ORGANIZATION REPORT NUMBER(S):
6a NAME OF PERFORMING ORGANIZATION: USARIEM and NRD&EC; 6b OFFICE SYMBOL (If applicable): SGRD-UE-NR	7a NAME OF MONITORING ORGANIZATION: US Army Medical Research & Development Cmd
6c ADDRESS (City, State, and ZIP Code): Natick, MA 01760-5007	7b ADDRESS (City, State, and ZIP Code): Fort Detrick, Frederick, MD 21701-5012
8a NAME OF FUNDING/SPONSORING ORGANIZATION; 8b OFFICE SYMBOL (If applicable):	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER:
8c ADDRESS (City, State, and ZIP Code):	10 SOURCE OF FUNDING NUMBERS: PROGRAM ELEMENT NO. 63002D; PROJECT NO. 3M263002D819; TASK NO. AI; WORK UNIT ACCESSION NO. DA305222

11 TITLE (Include Security Classification): An Evaluation of the Nutritional Intake and Acceptability of the Meal, Ready-to-Eat Consumed With and Without a Supplemental Pack in a Cold Environment.

12 PERSONAL AUTHOR(S): Edwards, J.S.A., Roberts, D.E., Morgan, T.E. and L.S. Lester.

13a TYPE OF REPORT	13b TIME COVERED	14 DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Final	FROM Jan 89 TO May 89	18 May 1989	109

16 SUPPLEMENTARY NOTATION:

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Ration Meal, Ready-to-Eat, Supplemental Pack, Calorie Intake, Body Weight Loss, Fluid Intake, Acceptability.

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

The Meal, Ready-to-Eat (MRE) was adopted into service in 1985 as a replacement for the ration, the Meal Combat Individual, and now forms part of the Army Field Feeding System (AFFS). Its function is to provide an individual meal in field feeding environments when centralized feeding is either impractical or not possible.

Resulting from queries on the long term viability and acceptability of both the AFFS and MRE, a Task Force (Task Force 2000) headed by LTG Sennewald (Ret.) was established in 1988 to conduct a wide ranging

20 DISTRIBUTION/AVAILABILITY OF ABSTRACT	21 ABSTRACT SECURITY CLASSIFICATION	
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	Unclassified	
22a NAME OF RESPONSIBLE INDIVIDUAL: John S.A. Edwards, Major, ACC	22b TELEPHONE (Include Area Code): (508) 651 5309	22c OFFICE SYMBOL: SGRD-UE-NR

study and canvass the views of Commanders, officers and soldiers at all levels. This Task Force has initially determined an urgent need for a supplemental pack to enhance the acceptability of the earlier versions of the MRE (MRE IV through VII). Accordingly, a separate pack has been developed which incorporates those items most often requested by soldiers.

In order to determine suitability of using this pack to enhance the nutritional intake and acceptability of the older versions of the MRE in addition to providing the basis of a cold weather supplement for the new MRE (MRE VIII), a 10 day field trial was held in Alaska in March 1989 with troops from A Companies of both the 1st and 2nd Bn 17th Infantry, 6th Infantry Division (Light), who were taking part in an evaluation exercise.

Approximately half of the troops in one Company were fed 4 MRE VIs and the other half 3 or 4 MREs VIIIs daily. In the other Company, half of the troops were fed 3 MRE VIs plus a supplemental pack and the other half, 3 MRE VIIIs plus a supplemental pack daily.

Initial body weights, heights, blood and urine samples were taken on all subjects and, on a smaller sample, activity monitors were attached, body circumference measurements taken and doubly labelled water administered to measure energy expenditure. Daily urine measurements were taken and dietary intake logs completed on the amount consumed and acceptability of individual food items along with questions related to water consumption. At the end of the trial, final body weight measurements, blood and urine samples were taken from all subjects and, for the smaller group, further body circumference measurements along with additional measurements for the doubly labelled water. A final questionnaire was also administered.

This report addresses only those aspects of the methodology, results and discussion concerned with whether the supplemental pack enhances the acceptability and nutritional intake derived from the MRE VI and provides information on which a procurement decision could be based.

The results suggest that adding the supplemental pack enhances the acceptability of MRE VIII food items but not MRE VI. However on the basis of the evidence provided from this trial, it does enhance the overall nutritional intake. In so far as the nutritional aspects are concerned, the supplemental pack was successful and should therefore be considered for purchase.

HUMAN RESEARCH AND DISCLAIMER STATEMENTS

Human subjects participated in these studies after giving their free and informed voluntary consent. Investigators adhered to AR 70-25 and USAMRDC Regulation 70-25 on Use of Volunteers in Research.

The views, opinions and findings contained in this report are those of the authors and should not be construed as an official Department of the Army position, policy or decision unless so designated by other official documentation.

Technical Report No T18-89

AN EVALUATION OF THE NUTRITIONAL INTAKE AND ACCEPTABILITY OF THE MEAL, READY-TO-EAT CONSUMED WITH AND WITHOUT A SUPPLEMENTAL PACK IN A COLD ENVIRONMENT

John S.A. Edwards, Major, Ph.D.[1]

Donald E. Roberts, Ph.D.[2]

Tanya E. Morgan, M.S. R.D.[3]

Laurie S. Lester, Ph.D.[4]

[1] British Army, Special Projects Officer
Military Nutrition Division
U.S. Army Research Institute of Environmental Medicine
Natick, Massachusetts 01760-5007

[2] Cold Research Division
U.S. Army Research Institute of Environmental Medicine
Natick, Massachusetts 01760-5007

[3] Military Nutrition Division
U.S. Army Research Institute of Environmental Medicine
Natick, Massachusetts 01760-5007

[4] Science and Advanced Technology Division
U.S. Army Natick Research, Development and Engineering Center
Natick, Massachusetts 01760-5007

FOREWORD

While a number of objectives were established for this trial, one of the early aims and therefore part of the initial rationale, was to develop a supplemental pack that could be used to enhance the acceptability and nutritional intake derived from the older Meals, Ready-to-Eat (MRE).

So that a timely decision can be made on whether or not supplemental packs should be purchased for this purpose, this Technical Report, containing sufficient data on which a decision can be made, has been prepared. To have followed the normal cycle and waited for a complete analysis of all data collected would probably have meant that the older MREs would have worked their way through the system.

This Report focuses principally upon nutrient intakes and food acceptability and is intended to provide sufficient information on which to base a procurement decision. It includes only those objectives, methodology, results and discussion pertinent to such a decision. A full Technical Report incorporating the remaining aspects will follow in due course.

ACKNOWLEDGEMENTS

This was not an easy study and without the assistance of a number of people and organizations, its success would probably have been in doubt. The authors would therefore like to express their thanks to the following people: to the United States Army Infantry Board, in particular CPT Kevin Kelly, for their hard work serving as the liaison between the individuals and units involved; to the staff of Fort Greely, in particular CPT Marvin Erikson and SFC Young, for their help and cooperation in providing the daily necessities required for any field study; to the staff of the United States Army Research Institute of Environmental Medicine, in particular the data collection teams of MAJ Amy Leitner, CPT Eileen Szeto, CPT Robert Moore, Carol Baker, Elaine Christensen, Debbie Jezior, Rick Mahnke, Dean Harris, SPCs Scott, Butkovich, Masiker and Hughes who were involved in the trial and who at times went through considerable hardship to collect data, to Dan Williams for his statistical and graphic support, to Harris Lieberman Ph.D. for the use of computer software to analyze sleep/wake patterns of the ambulatory activity monitors, to SSG John Hodenpel for his laboratory work and SSG Anna Rodriguez for her administrative support; to Natick Research Development and Engineering Center, in particular Larry Lesher (Geo Centers, Inc.) for statistical support and to Joanne Edinberg (Geo Centers, Inc.) for her contribution to the design and analysis of the final questionnaire and the writing of some sections on ration acceptability; to the Food Engineering Directorate, Natick Research Development and Engineering Center, in particular Raymond Mansur, for their help with rations and supplemental packs; and to the Atmospheric Science Laboratory, Alaska Meteorological Team, for the provision of meteorological data. Finally we would like to sincerely thank the soldiers of A Companies of both the 1st and 2nd Battalions, 17th Infantry, 6th Infantry Division (Light), without whom this trial would have been impossible.

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ABSTRACT

The Meal, Ready-to-Eat (MRE) was adopted into service in 1985 as a replacement for the ration, the Meal Combat Individual, and now forms part of the Army Field Feeding System (AFFS). Its function is to provide an individual meal in field feeding environments when centralized feeding is either impractical or not possible.

Resulting from queries on the long term viability and acceptability of both the AFFS and MRE, a Task Force (Task Force 2000) headed by LTG Sennewald (Ret.) was established in 1988 to conduct a wide ranging study and canvass the views of Commanders, officers and soldiers at all levels. This Task Force has initially determined an urgent need for a supplemental pack to enhance the acceptability of the earlier versions of the MRE (MRE IV through VII). Accordingly, a separate pack has been developed which incorporates those items most often requested by soldiers.

In order to determine suitability of using this pack to enhance the nutritional intake and acceptability of the older versions of the MRE in addition to providing the basis of a cold weather supplement for the new MRE (MRE VIII), a 10 day field trial was held in Alaska in March 1989 with troops from A Companies of both the 1st and 2nd Bn 17th Infantry, 6th Infantry Division (Light), who were taking part in an evaluation exercise.

Approximately half of the troops in one Company were fed 4 MRE VIs and the other half 3 or 4 MREs VIIIs daily. In the other Company, half of the troops were fed 3 MRE VIs plus a supplemental pack and the other half, 3 MRE VIIIs plus a supplemental pack daily.

Initial body weights, heights, blood and urine samples were taken on all subjects and, on a smaller sample, activity monitors were attached, body circumference measurements taken and doubly labelled water administered to measure energy expenditure. Daily urine measurements were taken and dietary intake logs completed on the amount consumed and acceptability of individual food items along with questions related to water consumption. At the end of the trial, final body weight measurements, blood and urine samples were taken from all subjects and, for the smaller group, further body circumference measurements along with additional measurements for the doubly labelled water. A final questionnaire was also administered.

This report addresses only those aspects of the methodology, results and discussion concerned with whether the supplemental pack enhances the acceptability and nutritional intake derived from the MRE VI and provides information on which a procurement decision could be based.

The results suggest that adding the supplemental pack enhances the acceptability of MRE VIII food items but not MRE VI. However on the basis of the evidence provided from this trial, it does enhance the overall nutritional intake. In so far as the nutritional aspects are concerned, the supplemental pack was successful and should therefore be considered for purchase.

INTRODUCTION

The Meals, Ready-to-Eat (MRE) comprise mainly thermo-processed (wet pack) food components requiring a minimum or no preparation and utilizing flexible, high barrier packing materials. They were adopted into service in 1985 as a replacement for the ration, the Meal Combat Individual, and now form part of the Army Field Feeding System (AFFS). Their function is to provide individual meals in field feeding environments when centralized feeding is either impractical or not possible. The Office of the Surgeon General recommends (1) that "MREs not be used as the sole source of subsistence for longer than ten days".

As part of a continuing evolutionary process, a number of improvements have been made to the MREs: a chronological summary of the developments is provided in Appendix A. These improvements have been evaluated in a number of field studies (2, 3, 4, 5) but in order to provide the basis for a decision to be made on which version to procure for FY 88 Date of Pack, a dedicated test was conducted which compared MRE IV, MRE VII and MRE VIII (6).

More recently, queries have arisen on the long term viability and acceptability of both the AFFS and MRE and to address these, a Task Force (Task Force 2000) headed by LTG Sennewald (Ret.) was established in 1988 to conduct a wide ranging study and canvass the views of Commanders, officers and soldiers at all levels. This Task Force has initially established (7) an urgent need for a supplemental pack to enhance the acceptability of MRE IV through VII. Accordingly, a separate package was developed by the Food Engineering Directorate, Natick Research Development and Engineering Center, which incorporated those items most often requested by soldiers. Details of this Supplemental Pack are given in Appendix B.

A number of concerns have been expressed on this supplemental pack as to whether the modifications constitute an improvement and whether or not soldiers would eat the supplemental pack in addition to or in place of the MRE and hence ingest sufficient nutrients to maintain and optimize their performance. In addition, concern has again been expressed as to whether the retort pouch can withstand the rigors of a cold environment and how well soldiers cope with pouches when they are frozen.

AIMS

In order to address these issues before a supplemental pack is accepted into service, a limited trial was conducted with the aims of establishing:

1. Whether soldiers fed the MRE VI or VIII, with or without supplements, consume sufficient calories to maintain their body weight within acceptable limits.
2. Whether soldiers fed the MRE VI or VIII, with or without supplements, consume sufficient quantities of menu items to adequately meet the Office of the Surgeon General's Military Recommended Dietary Allowances for protein, vitamins and minerals.
3. The acceptability and suitability of the supplemental pack for use as a calorie, cold weather supplement.
4. Whether water consumption is adequate to maintain hydration status.
5. The acceptability ratings of the MRE VI and VIII, with and without supplements, that are consumed in a cold environment.
6. Whether the retort pouch is compromised in a cold environment.
7. What particular problems are posed by the MRE on the soldier in a cold environment and how well he can cope with them.
8. To provide further data on the energy requirements of soldiers working in a cold environment.

This Report primarily addresses the first two aims of this trial in establishing whether the supplemental pack enhances the acceptability and nutritional intake derived from the older versions of the MRE (MRE VI).

TEST CRITERIA

The following criteria were established for this trial:

Nutritional Adequacy

The mean daily intake of energy, protein, fat, vitamins and minerals for each test group should meet, if not exceed, the Military Recommended Dietary Allowances (8), Table 1.

Body Weight

The mean body weight loss or gain for each test group should not exceed 3% of the initial body weight at any time during the test.

Hydration Status

The mean urine specific gravity for each test group should not exceed 1.030 at any time during the test.

Food Acceptability

The mean acceptability ratings of each food item component must not be less than the mid point on the Hedonic Scale.

Environmental Constraints

Rations should not be presented in a frozen state more than 10% of the time. No more than 10% of any pouch should sustain damage as a result of freezing or other environmental reason.

Supplemental Pack

Soldiers receiving the supplemental pack should not consume quantities of nutrients significantly less than that recorded for the unsupplemented group.

Table 1. Military Recommended Dietary Allowances.

Nutrient	Unit	Dietary Allowance	
		Temperate Climate	Cold Climate
Energy	kcal	3200 (2800-3600)	4500
Protein	gm	100	100
Vitamin A	mcg RE	1000	1000
Vitamin D	mcg	10	10
Vitamin E	mg TE	10	10
Ascorbic Acid	mg	60	60
Thiamin	mg	1.6	1.6 *
Riboflavin	mg	1.9	1.9 *
Niacin	mg NE	21	21 *
Vitamin B6	mg	2.2	2.2
Folacin	mcg	400	400
Vitamin B12	mcg	3	3
Calcium	mg	800-1200	800-1200
Phosphorus	mg	800-1200	800-1200
Magnesium	mg	350-400	350-400
Iron	mg	10-18	10-18
Zinc	mg	15	15
Iodine	mcg	150	150
Sodium	mg	5500	5500

* Notes:

For extended periods of high energy expenditure additional B Vitamins may be required.

Thiamin 2.3 mg - calculated as 0.5 mg/1000 kcal (Reference 9).
Riboflavin 2.7 mg - calculated as 0.6 mg/1000 kcal (Reference 9).
Niacin 30.0 mg NE - calculated as 6.6 mg/1000 kcal (Reference 9).

METHODOLOGY

This study was approved by the Human Use Committees of the United States Army Research Institute of Environmental Medicine and the Army Surgeon General.

Prior to the beginning of the trial, all personnel involved in collecting data in Alaska underwent mandatory cold weather training organized and run by the Director of Plans and Training at Fort Greely. This training involved a series of lectures and presentations on various aspects of living, operating and surviving in a harsh Arctic environment and included spending a night in the field sleeping in temporary shelters.

Operational Scenario

Overview

A field Evaluation Exercise (EXEVAL) held in the training area of Fort Greely, Alaska, provided the basis for the trial and the units involved followed a training and evaluation schedule determined by 1st Brigade Headquarters, 6th Infantry Division (Light) (6th ID (L)). The EXEVAL was conducted during the first two weeks of March under winter conditions.

One Company deployed at midday into an air assault operation prior to moving into an assembly area to guard Critical Sites. Over the next 2 days they received a series of attacks and on day 5 withdrew in a 12 km road march to a further assembly area. On day 6 they moved to contact over approximately 6 km prior to mounting a hasty attack. There they set up a defensive position and over the next 2 days consolidated this position sending out regular patrols. On day 9 they suffered attacks prior to withdrawing again over approximately 8 km to an assembly area. Day 10 was spent planning for an air assault operation which was subsequently mounted at midnight. This was followed through on day 11 with an air assault and a road march to their final position.

The second Company air landed and deployed late on day 2 of the test and occupied an assembly area. On day 4 they crossed the river, via an ice bridge, travelling approximately 8 km and a further 6 km the following day. On day 6 they moved to contact, mounted an attack,

set up a defensive position and patrolled forward. On day 9 they attacked and followed through into a deliberate defensive position. On day 11 they were attacked in the early hours, withdrew and ended the exercise with a road march of approximately 12 km.

Experimental Design

Overview

Prior to deployment, subjects were briefed and initial measurements of body weight, height, blood and urine samples taken from all subjects and, on a smaller sample, activity monitors attached. The units then deployed to the field to follow their own training and evaluation schedule. The duration of the study was 10 days for one Company (2 groups) and 11 days for the other although the units continued thereafter with their military evaluation exercise. The 4 test groups were assigned a daily eating regimen as follows:

		Total Calories per Day
Group 1.	4 x MRE VI.	4816
Group 2.	3.5 x MRE VIII (7 per 2 days).	4571
Group 3.	3 x MRE VI plus 1 x supplemental pack.	4253
Group 4.	3 x MRE VIII plus 1 x supplemental pack.	4559

Whenever possible test subjects were met daily at which time, urine samples and completed Dietary Logs were collected. Daily ration resupply was also completed at this stage as part of the test schedule.

At the end of the study, final body weights were obtained, blood and urine samples were taken from all subjects and activity monitors recovered from the smaller sub groups. Two final questionnaires were also administered.

Test Subjects

Test subjects were recruited from A Company, 1st Battalion (A/1/17) and A Company, 2nd Battalion (A/2/17), 17th Infantry, both part of the 1st Brigade, 6th Infantry Division (Light) stationed at Fort Richardson, Alaska. Subjects were assigned to test groups by platoons in order to provide approximately 35 subjects in each test group. Each group was then assigned a group number (1 thru 4). The allocation of platoons to test groups is summarized in Table 2.

Table 2. Allocation of Platoons to Test Groups.

Test Group	Company/Platoon
	A/1/17
1	HQ Platoon
MRE VI	1st Platoon
2	2nd Platoon
MRE VIII	3rd Platoon
	A/2/17
3	HQ Platoon
MRE VI + Supplement	3rd Platoon
4	1st Platoon
MRE VIII + Supplement	2nd Platoon

Prior to the start of the trial, soldiers of both Companies were assembled in their respective day rooms and given a comprehensive briefing. Detailed topics covered included the background, aims and objectives of the study, data collection procedures, the duties of each participant, the procedures and risks involved, action to preserve the confidentiality of the data and a subject's right not to take part in the study or to withdraw at any time. They were also warned that additional or privately purchased food ("pogey bait") would not be permitted at any stage during the study and that personal effects and all resupply vehicles entering the training

soldiers so that they could direct any specific medical questions to him.

In order to standardize data collection procedure, an overhead projector and viewgraphs were used to instruct subjects on the correct completion of the Daily Dietary Logs. After the briefing, all of those subjects asked, volunteered to take part and signed the Volunteer Agreement Affidavits (Appendix C). A second copy of this Agreement was provided for subjects' individual retention along with an outline summary of the trial (Appendix D). The opportunity was also taken at this stage to introduce data collectors to the subjects in order that the process of familiarization could begin. Before leaving the briefing, subjects were given a urine container and asked to return it the following morning with their first morning void as instructed during the briefing.

Pre-Test Measurements

The morning following the briefing and prior to breakfast, subjects were again brought together in one Company day room where pre-test measurements were taken. A/1/17 assembled at 0530 hours and A/2/17 at 0645 hours.

On arrival at the day room, subjects' names were checked to ensure that they had been briefed and that they had completed both the Volunteer Agreement and Volunteer Registry Forms. This was not the case for 7 personnel and they were therefore briefed in a similar manner as the previous day, invited to ask questions before signing the Volunteer Agreement and Registration Forms.

Once subjects had been checked in they were given a color coded card (Appendix E) and allocated a subject number in accordance with their group number (Group 1, subject numbers 100s: Group 2, subject numbers 200s, etc) before going to various stations for the pre-measurements to be taken. Once a measurement had been taken, the card was annotated prior to subjects moving to the next station. On completion of all measurements, subjects handed in

their cards where completion was verified before, leaving the day room.

Blood

Fasting blood samples (30 cc) were drawn by venipuncture, without stasis, by a trained phlebotomist provided by the Medical Company (6th ID) and supervised by accredited United States Army Research Institute of Environmental Medicine (USARIEM) personnel. Subjects were seated and samples were taken from the antecubital vein and drawn into serum vacutainers. Two (10 cc each) Serum Separator tubes (SST) were used for serum samples and one (10 cc) Ethylenediaminetetraacetic Acid (EDTA) tube was used for determination of hemoglobin and hematocrit. After the blood in the SST tubes had clotted, the tubes were centrifuged and the serum poured into 4.5 ml cryo tubes for storage (-40^{O}F) and shipment to a clinical laboratory (MedPath, Boston, MA) for analysis. Two samples were prepared with one serving as a backup. The remaining unfrozen serum was used to measure serum osmolality (Wescor vapor pressure method). The EDTA tubes were well mixed, the hematocrit was determined by centrifugation and the hemoglobin was determined by the cyanomethohemoglobin method. All tests were performed in duplicate.

Serum Analysis

Serum samples were analyzed to determine changes in hydration and nutritional status from the beginning to the end of the field test. A standard panel of clinical tests were performed by MedPath which included:

Albumin
Alkaline Phosphatase
Bilirubin, Total
Calcium
Carbon Dioxide
Chloride
Cholesterol
Creatinine
Glucose
Iron
Lactic Dehydrogenase (LDH)
Phosphorus, Inorganic
Potassium
SGOT (AST)
SGPT (ALT)
Sodium
Protein, Total
Triglycerides
Urea Nitrogen (BUN)
Uric Acid
A/G Ratio
BUN/Creatinine Ratio
Electrolyte Balance
Globulin
HDL Cholesterol

Urine

A first void, mid stream urine sample was collected on each day of the field trial and on the morning of the pre blood sample. Samples were collected in 50 cc tubes with a screw top. Each sample was analyzed for:

Urinary Ketone
Urinary Protein
Leucocytes
pH
Specific Gravity
Sodium
Potassium

Body Weight and Height

Body weights were measured using the Seca digital electronic battery operated scales accurate to $\pm$ 0.1 lb. Scales were calibrated, subjects asked to strip and weighed in their "boxer shorts" and socks. Heights were measured at the same time to $\pm$ 0.1 cm.

Activity Levels

Activity levels were measured to determine sleep/wake patterns in each group and to permit a comparison to be made between the 4 test groups. Subjects (five from three groups and 10 from the fourth group) were fitted with ambulatory activity monitors (Ambulatory Monitoring, Inc., Ardsley, N.Y.). These monitors are compact (2.5" x 3.5" x 0.75"), lightweight (3 oz) microprocessor based units which were attached to the subjects' wrists. They do not restrict the normal range of motion nor interfere with a normal training schedule. Prior to being attached, they were initialized to record motor activity in 3 minute epochs for a 10-day period. The activity monitors were then attached and checked regularly to ensure their presence and correct fitting. At the end of the trial, the monitors were recovered and the information stored in them down-loaded via an interface onto a lap-top computer. Analysis of the data was then performed using a sleep/wake scoring algorithm for wrist activity (10).

Daily Measurements

Nutrient Intake

All subjects were asked to record their daily food intake using a 24 hour Dietary Log: an example of this log is given at Appendix F. Subjects selected from the itemized list of foods those which had been consumed during the 24 hour period and circled their estimated portion size (1/4, 1/2, 3/4, 1, 2). Where portion sizes were larger than those listed, these were written in. Trained dietary data collectors interviewed subjects daily when collecting the previous day's log. Obvious omissions, ambiguities and queries were resolved then and the next 24 hour Dietary Log and day's supply of food issued. In addition, each soldier collected, in a plastic trash bag, his empty wrappers, unwanted food and food waste. This bag was retrieved from the subjects and used as a basis for comparison with the food logs. Care was exercised to ensure that soldiers did not complete their 24 hour Dietary Log on the basis of what empty wrappers they were returning.

Food Acceptability

Food acceptability was assessed in the field on a daily basis using the 24 hour Dietary Logs (Appendix F) on which to record acceptability ratings of individual food items. A 9-point hedonic scale (1 = 'dislike extremely', 5 = 'neither like nor dislike' and 9 = 'like extremely') was used for this purpose. When completing the Dietary Logs, subjects were instructed to record their own views. Food did not necessarily have to be tasted on each occasion for a value judgement to be made. A food, for example, may be disliked and therefore not eaten. When this happened, subjects were asked to record that they did not eat that item and only to record their hedonic rating.

When foods were not consumed or finished, the reason for doing so was recorded on the Dietary Log. The reason was recorded by reference to a code number which appeared at the top of the sheet.

Water Consumption

Water consumption was ascertained using self reporting procedures on the reverse of the 24 hour Dietary Log. Subjects were asked to record the number of canteens of water drunk either as plain water; used and consumed as a beverage, for example coffee; or mixed with food. They were asked to do this during 3 time frames: morning, afternoon and evening. Although no specific times were given, these time frames were selected in part to help subjects recall when they had used and consumed water and in part to provide a broad indication of when consumption took place. They were also asked to state, by checking one item, the primary source or origin of that water. The primary sources were thought likely to be, Water Buffalo or melted snow. Where this was not the case, alternative sources were asked to be identified.

In addition to water consumption, subjects were also asked to make value judgements on aspects connected with that day's urine. They were asked to rate a number of aspects of their urine by circling the number that most closely corresponded with their views. The lightness or darkness of their urine was rated using a 7 point scale where 1 = 'extremely light' and 7 = 'extremely dark'. Color was rated on a 4 point scale 1 = 'light yellow' to 4 = 'brown'. Frequency of urination was rated on a 7 point scale 1 = 'extremely less' to 7 = 'extremely more' while volume was rated again on a 7 point scale 1 = 'extremely less to 7 ' extremely more'

Post-test Measurements

Post-test measurements were taken on 2 separate mornings; A/1/17 on T+11 and A/2/17 on T+12. This was done partly to relieve the administrative and logistic burden but primarily as each day provided a convenient window in that Company's training and evaluation schedule. On the first morning, 2 separate 10 man Arctic tents, vacated by soldiers, were used and on the second morning the Battalion Aid Station was used. Tents were heated by Yukon stoves to approximately 70^{o}F. On both mornings subjects were called to the tent as required thereby causing minimum inconvenience and waiting in the cold.

Blood

Fasting blood samples were taken in a similar manner to the pre-test measurements. The first morning samples were transported by MEDEVAC Helicopter and the second morning samples by ambulance to Fort Greely where they were treated as already described.

Body Weight

Body weights were measured using the Seca digital battery operated scale. In the three tents, scales were placed on rigid boards on flat, level parts of the ground. Subjects were asked to strip to their "boxer shorts" or other such underwear as they had on.

Final Questionnaires

Two final questionnaires developed by Natick Research Development and Engineering Center were administered on the last day of the study. The first of these questionnaires requested information appertaining to a chemical ration heating Device (Zestotherm) that had been proposed for use with the MRE. Presentation and discussion of these results will be included in a later Technical Report. The second questionnaire (Appendix G) was designed to collect demographic information, to assess troop opinions on general aspects of the ration and supplement and to obtain final acceptability ratings of each item in the ration and supplement. This final questionnaire was administered to all test participants. The opportunity was also taken to canvass the opinion of both Company soldiers who engaged in similar activities and ate the same rations, but were not test subjects.

Meteorological Data

Meteorological data was collected daily by the Atmospheric Science Laboratory, Alaska Meteorological Team, located at Fort Greely, as part of their routine weather forecasting operation. Hourly readings were taken of actual, minimum and maximum temperatures, wind speed and direction, wind chill, solar radiation, and precipitation from 4 remote weather stations located in the training area used for the trial and further measurements from the main weather station at Fort Greely. Times of sunrise and sunset were also recorded.

Timeline

A timeline of the trial is given at Table 3.

Table 3. Timeline of the Field Study.

Activity	Test Day													
	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12
Briefing	X														
Pre-test Measurements															
Weight		X													
Height		X													
Urine S.G.		X													
Blood Sample		X													
Units Deploy			1	2											
Daily Measurements															
Food/Water Intake				1	X	X	X	X	X	X	X	X	X	X	2
Food Acceptance				1	X	X	X	X	X	X	X	X	X	X	2
Urine S.G				1	X	X	X	X	X	X	X	X	X	X	2
Activity Monitor		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Post-test Measurements															
Weight														1	2
Urine S.G.														1	2
Blood Sample														1	2
Final Questionnaires														1	2

X All Personnel
0 Limited Sample Only
1 A/1/17 personnel only
2 A/2/17 personnel only

Ration Resupply

Due to the complexity and critical nature of the ration issue program, resupply was undertaken as part of the study protocol. On deployment, groups were issued with rations for the following 24 hours. On days 2 and 3, prior to groups crossing a strategic river, via an ice bridge, an additional day's rations, Dietary Logs and urine tubes were issued and held in reserve by the Company Headquarters to act as a buffer in case there was a break in the line of resupply. Details of the ration issue schedule are given in Table 4.

Table 4. Daily Ration Issue Schedule.

Activity		Day/Number of MREs and Supplements												
		0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12
A/1/17														
Group 1	MRE VI	3	4	4 +4*	4	4	4	4	4	4	4	4	3	
Group 2	MRE VIII	3	4	3 +4*	4	3	4	3	4	3	4	3	4	
A/2/17														
Group 3	MRE VI		3	3	3 +3*	3	3	3	3	3	3	3	3	3
	Supplement		1	1	1 +1*	1	1	1	1	1	1	1	1	1
Group 4	MRE VIII		3	3	3 +3*	3	3	3	3	3	3	3	3	3
	Supplement		1	1	1 +1*	1	1	1	1	1	1	1	1	1

* Issued and held in reserve by Company Headquarters.

Hydration Status

Hydration status was assessed by several methods (both direct and indirect). The standard method involves measurement of changes in hematocrit and hemoglobin in the blood (indicative of decreased circulating volume) and the specific gravity and sodium/potassium ratios in urine (indicative of decreased clearance or increased reabsorption of water).

Data Analysis

Data has been analyzed to address the overall aims of the study using the statistical analysis package Statistical Package for the Social Sciences (SPSS^X), and at USARIEM, specifically developed software in conjunction with a Digital VAX 780.

Demographic Data

The questionnaire used to collect Demographic information was optically mark read and means and standard error were calculated. Analysis of variance (ANOVA) were used, where appropriate, to determine if there were any differences among the four groups. Existence of cells with expected frequencies less than five prohibited use of Chi Square analysis of the frequency data.

Body Weight, Height and Age

Pre- and post-measurements of body weight and height were entered into the computer using a universal data entry program. Where, however, no post-test weight was available, either because the subject had been dropped from the study or was not available at the end, the pre-measurements were not included. Mean body weight and height were calculated together with standard deviations and ranges. A one-way Analysis of Variance was used to determine if a significant difference existed between the 4 groups. A paired t-test was used to ascertain if there was any significant change between the pre- and post-weights.

Subjects' ages were extracted from Volunteer Agreement and Volunteer Registry Forms and treated in a similar manner to body weight and height.

Nutrient Intake

On return from the field, 24 hour Dietary Logs were reviewed and checked for completion. Where any doubt existed on the validity of the diary, it was excluded at this stage. Data was then input into the computer using a universal data entry program. Once complete, a hard copy was produced which was then verified by the data collection team concerned. Any corrections were marked and these were re-entered into the computer. A further hard copy was produced and the corrections verified. A final random check was then made for accuracy.

On return to Natick a series of further checks were made and the data randomly checked for accuracy. One output, for example, identified caloric consumption which was either below 1000 kcal or above 5000 kcal. Leaders from the data collection teams then re-checked the Dietary Logs to confirm that no error had been made. Where errors were identified, these were corrected; if results were plausible these remained. However, if there was any doubt as to the validity of the data these were excluded. Although 2 groups deployed on day 1 and 2 groups late on day 2, all data sets have been treated as if the trial started on day 1 and, for the purpose of this report, both limited to 10 days.

Nutritional adequacy of the actual dietary intakes has been determined by comparing calculated nutrient intakes to the Military Recommended Dietary Allowances (MRDA). Nutritional adequacy has been determined for energy, fat, protein, carbohydrate, vitamin A, ascorbic acid, thiamin, riboflavin, niacin, vitamin B6, folacin, vitamin B12 , calcium, phosphorus, iron, magnesium, zinc and sodium. Total daily intakes of macro nutrients (protein, fat and carbohydrate) together with energy have been calculated and presented and mean daily intakes for each micro nutrient presented as a percentage of the MRDA.

Acceptability of the Rations

Ration and supplement acceptability were assessed by statistical analysis of the hedonic ratings (rating scale: 1 = dislike extremely, 5 = neither like nor dislike, 9 = like extremely) assigned to individual food and drink items. Variations between food items and ration groups were determined using paired t-tests.

RESULTS AND DISCUSSION

Study Sample

Volunteers for this study were provided by A Companies, 1st and 2nd Battalion 17th Infantry, both part of the 1st Brigade, 6th Infantry Division (Light) stationed at Fort Richardson, Alaska. The original protocol required that a minimum of 35 personnel be assigned to each test group and subjects were recruited accordingly. However, as with any trial, a number of subjects failed to complete the full trial. These details are summarized in Table 5.

Table 5. Details of Study Sample

Company/ Group	Subjects Recruited	Failed to Deploy	Failed to Complete	Completed Study
A/1/17				
Group 1	36	2	1	33
Group 2	39	2	5	32
A/2/17				
Group 3	36	1	5	30
Group 4	38	1	2	35

Demographic Information

Demographic information was collected as part of a final questionnaire which was completed by 139 male subjects on the last day of the field exercise. All responses were self-reported by subjects. Table 6 summarizes demographic information by group. It includes summary statistics on type of climate subjects were most used to, distribution of ranks, number of years subjects had been in the Armed Services.

Table 6. Demographic Information by Group.

	Group 1 MRE VI (n = 35)	Group 2 MRE VIII (n = 36)	Group 3 MRE VI + Supplement (n = 30)	Group 4 MRE VIII + Supplement (n = 38)	Overall (n =139)
Years of Service (%)					
0 - 2	42.8	27.8	33.3	47.8	38.1
3 - 5	31.4	52.8	36.7	28.9	37.4
6 - 10	20.0	19.4	10.0	13.2	15.8
11 - 15	0	0	16.7	10.5	6.5
16 - 20	5.7	0	3.3	0	2.2
Distribution of Ranks (%)					
Enlisted					
E - 1	2.9	0	6.9	2.6	2.9
E - 2	0	0	0	13.2	3.6
E - 3	40.0	13.9	17.2	28.9	25.4
E - 4	25.7	50.0	44.8	21.1	34.8
E - 5	20.0	22.2	6.9	21.1	18.1
E - 6	5.7	8.3	20.7	7.9	10.1
E - 7	2.9	0	3.4	2.6	2.2
Officers					
O - 1	0	2.8	0	0	0.7
O - 2	2.9	2.8	0	2.6	2.2
Climates (%)					
Hot	28.6	25.7	23.3	23.7	25.4
Cold	5.7	25.7	20.0	21.1	18.1
Mixed	45.7	28.6	50.0	44.7	42.0
Temperate	20.0	20.0	6.7	10.5	14.5

* Percentages are based on the number of subjects who responded to each question.

As is apparent from Table 6, there was some variation between groups with regard to rank. However, almost all subjects were enlisted soldiers whose ranks ranged from E-1 to E-7. Most had been in the Armed Services for five years or less.

Subjects in the four groups were similar in terms of the type of climate they had lived in the longest. For the most part, subjects had lived in either a hot or mixed climate for most of their lives; only about one fifth of subjects had lived most of their life in a cold climate.

Body Weight and Height

Details of body weight are presented in Table 7. The overall mean pre-weight was 173.7 lb and ranged from 119.7 lb to 239.4 lb. There were no significant differences between the 4 groups. The overall mean post-weight was 170.1 lb and ranged from 115.3 lb to 234.6 lb. Again there were no significant differences between the groups. However significant differences did exist for all groups between the pre and post-weights. In total, 26 of the 127 for whom both pre- and post-weights were taken gained weight; 3 from group 1; 7 from group 2; 8 from group 3; and 8 from group 4. There was no change for 1 subject, the remainder lost weight. The overall mean weight loss was 3.6 lb with the highest, 4.8 lb, in group 1 (MRE VI only) and the lowest, 3.0 lb, in group 4 (MRE VIII plus supplement). Percentage weight losses ranged from 2.8% in group 1 to 1.7% in group 4. These weight losses are within the limits of the established criteria.

Table 7. Changes in Pre- and Post-Weight of Groups.

	Group 1 MRE VI n = 32 lbs	Group 2 MRE VIII n = 31 lbs	Group 3 MRE VI + Supplement n = 30 lbs	Group 4 MRE VIII + Supplement n = 34 lbs
Pre-weight	173.2	171.8	173.9	175.8
Range	126.4-228.7	125.5-237.1	131.7-232.8	119.7-239.4
SD	21.2	26.5	24.2	25.3
Post-weight	168.4	168.3	170.6	172.8
Range	126.8-217.7	121.7-230.8	130.1-232.0	115.3-234.6
SD	19.9	24.6	24.0	23.9
Mean	4.8	3.5	3.3	3.0
SD	4.0	4.2	6.0	3.5
Change %	-2.8%	-2.0%	-1.9%	-1.7%

From the final questionnaire it can be seen that the majority of soldiers were not trying to either gain or lose weight during the field exercise (Table 8). Slightly more of the subjects in the MRE VI group were trying to lose weight than in the other groups; somewhat more of the subjects in the unsupplemented groups were trying to gain weight than in the supplemented groups.

Table 8. Details of Personnel Who Were Either Trying to Lose or Gain Weight.

	Group 1 MRE VI	Group 2 MRE VIII	Group 3 MRE VI + Supplement	Group 4 MRE VIII + Supplement	Overall
Trying to Lose Weight (%)	20.0	5.4	10.0	11.1	11.6
Trying to Gain Weight (%)	20.6	21.6	3.3	5.6	13.1

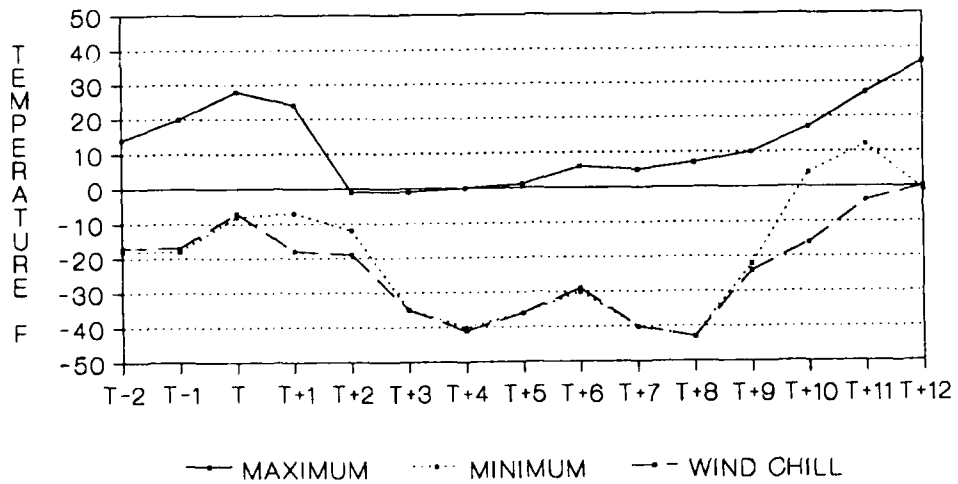
The overall mean height was 176.8 cm and ranged from 158.6 cm to 195.1 cm. There were no significant differences between the 4 groups.

The overall mean age was 24.6 years and ranged from 18 years to 39 years. There were no significant differences between the 4 groups.

Meteorological Data

Although meteorological data was collected from 5 sites, only the data appertaining to Fort Greely is reported here. Mean daily temperatures, maximum, minimum and wind chill are summarized in Figure 1.

Figure 1
Mean Daily Temperatures
Fort Greely, Alaska



Total hours of daylight at T-2 were 9 hours 59 minutes. This rose daily by approximately 7 minutes until T+13 when there were 11 hours 30 minutes daylight. Solar radiation is summarized in Table 9.

Table 9. Solar Radiation (Langley*) Recorded at Fort Greely, Alaska.

Day	Total Radiation (Langley*)
T-2	153
T-1	51
T	59
T+1	88
T+2	143
T+3	175
T+4	169
T+5	166
T+6	148
T+7	226
T+8	205
T+9	193
T+10	191
T+11	200
T+12	213

Note: * An electromagnetic radiation incident upon a surface: a value of energy per unit area equal to one calorie per square centimeter.

Precipitation, as snow, occurred on 4 days. However, this snow was particularly dry and when recorded each day as water, was either a trace or .01 inches.

Activity Levels

Of the twenty-five subjects who wore the actigraph monitors, 17 successfully completed the 10 day study. Due to the uneven drop-out rate amongst groups, activity data is reported by company. Mean wake and sleep time by day (24 hours) as well as for the entire study period (10 days) can be seen in Figures 2 and 3.

Figure 2
Percentage of Time Asleep

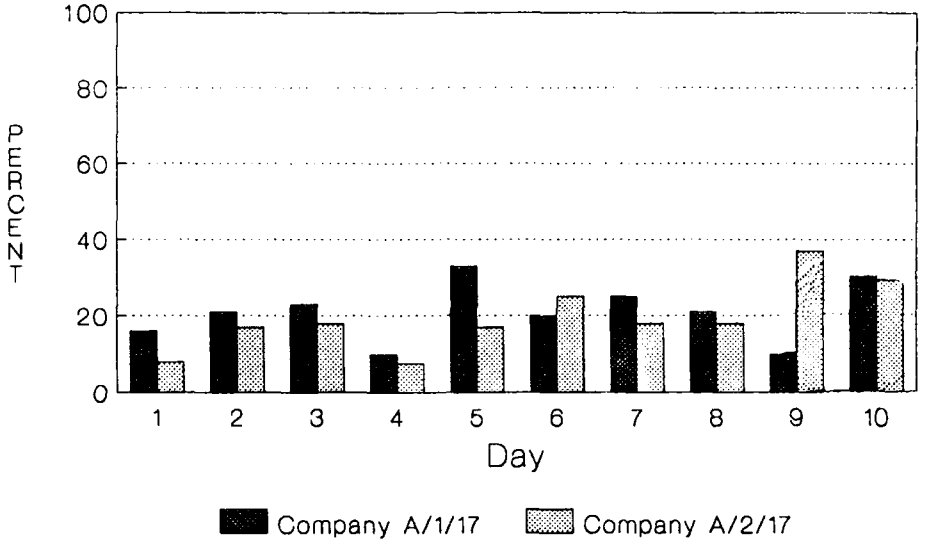
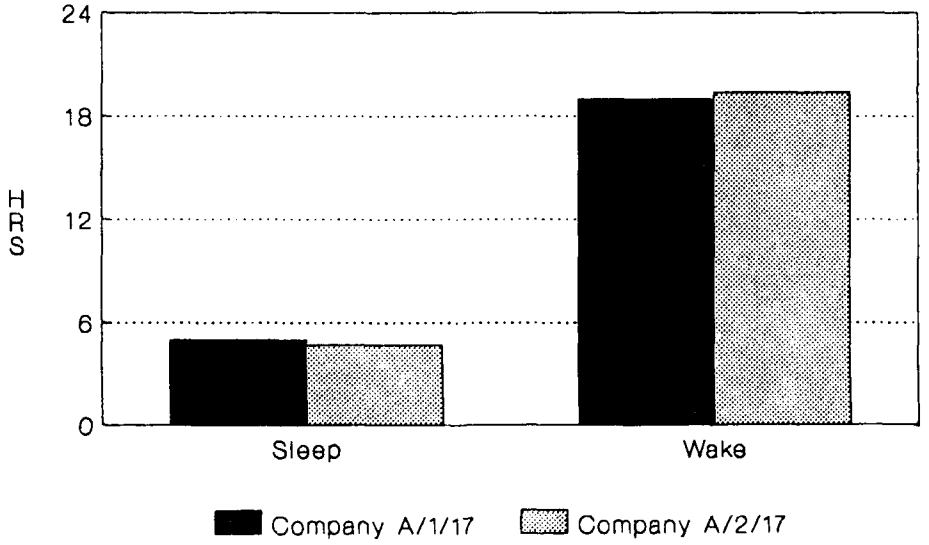


Figure 3
Mean Daily Hours of Sleep and Wake



Both A/1/17 and A/2/17 Companies had similar total sleep times obtaining 5.0 and 4.7 hours of sleep, respectively. Although the total sleep time attained was similar for both Companies throughout the study, this sleep was often intermittent in nature. Both Companies also experienced cycles in the amount of work and rest they received during the ten days. Company A/1/17 for example, experienced a drop in activity on days five and ten whereas Company A/2/17 had a less dramatic fall in activity on days three, six and nine.

Nutrient Intake

Nutrient intakes were calculated from the 24 hour Dietary Logs. Details of the valid number of Logs used are given in Table 10.

Table 10. Total Number of Valid Dietary Logs.

Day	Group 1 MRE VI	Group 2 MRE VIII	Group 3 MRE VI + Supplement	Group 4 MRE VIII + Supplement
1	34	24	33	33
2	32	33	32	35
3	31	31	29	33
4	32	23	29	34
5	20	11	28	34
6	23	17	29	35
7	27	25	31	34
8	27	20	31	35
9	29	27	30	35
10	27	28	29	34
Total	282	239	301	342
Mean	28.1	23.9	30.1	34.2

The total daily energy intake and intake of macro nutrients (protein, fat and carbohydrate) are presented in Figures 4, 5, 6 and 7. Although expressed as a daily consumption they can only, in this format, provide a broad indication of the actual daily consumption and an inter-comparison of these values is not strictly valid. This is due in part to the different activity levels of each group; the different time frame which the data represents; and to the method of data collection. Data collection took place at times convenient to the exercise

scenario and as such varied from group to group. The collection of Dietary Logs took place at different times of the day and consumption periods are therefore likely to vary between groups and may not necessarily reflect a 24 hour period.

What perhaps is of more value are the mean dietary consumption figures for the complete exercise period. Details of the mean daily energy intake and macro nutrients (protein, fat and carbohydrate) are presented in Figures 8, 9, 10 and 11. Figures for the remaining nutrients, expressed as a percentage of the MRDA, are presented in Figures 12 to 26. Where ranges are used in the MRDA, the lower values have been selected and used.

What must be of initial concern is the overall low consumption of calories particularly when compared with the MRDA. The lowest group (MRE VI) consumed 2009 kcal or 45 percent of the MRDA, Group 2 (MRE VIII) and Group 3 (MRE VI + supplement) consumed 2802 and 2830 kcal or 62 percent and 63 percent of the MRDA while Group 4 (MRE VIII + supplement) consumed 3553 kcal or 79 percent. Similar consumption patterns were demonstrated for protein, fat and carbohydrate.

In order to establish whether or not the differences between these groups are significant, a one way analysis of variance (Tukey) was conducted for Calories, protein, fat and carbohydrate. These results are presented in Table 11.

Figure 4
Total Daily Energy Consumption (kcal)

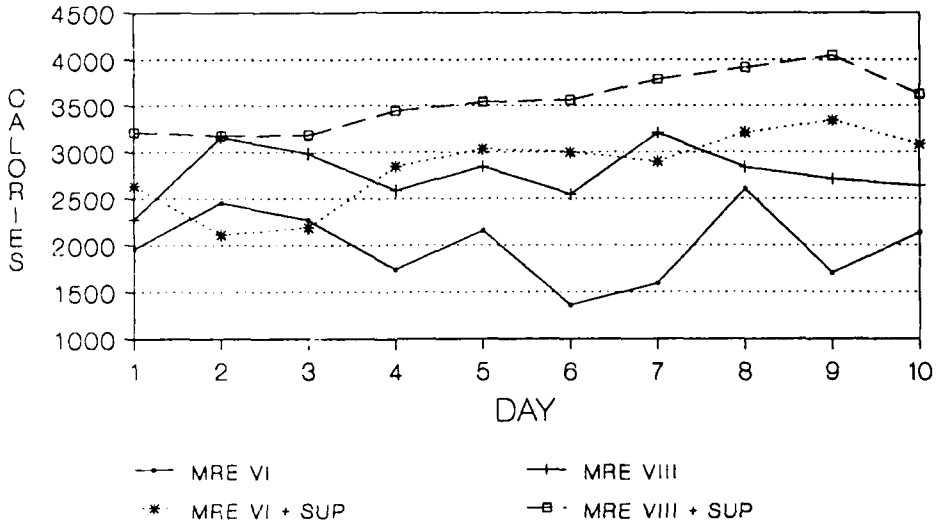


Figure 5
Total Daily Protein Consumption (g)

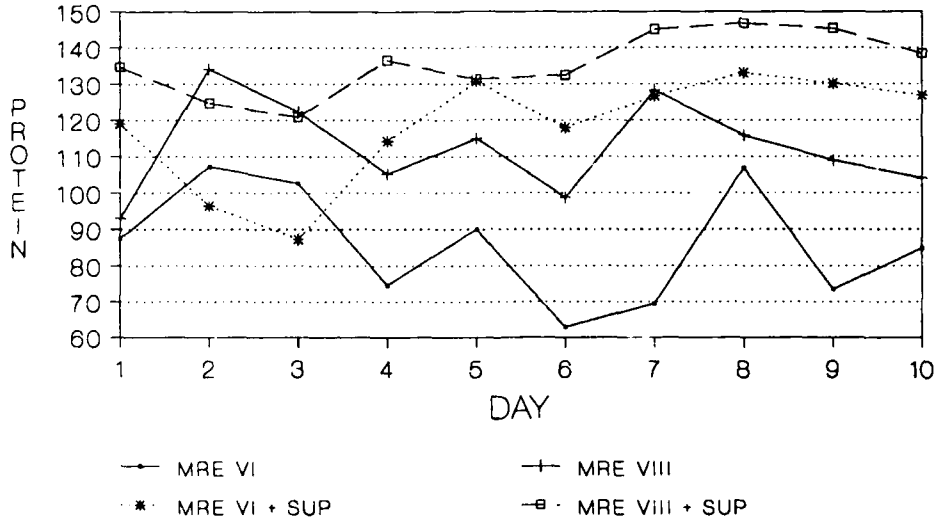


Figure 6
Total Daily Fat Consumption (g)

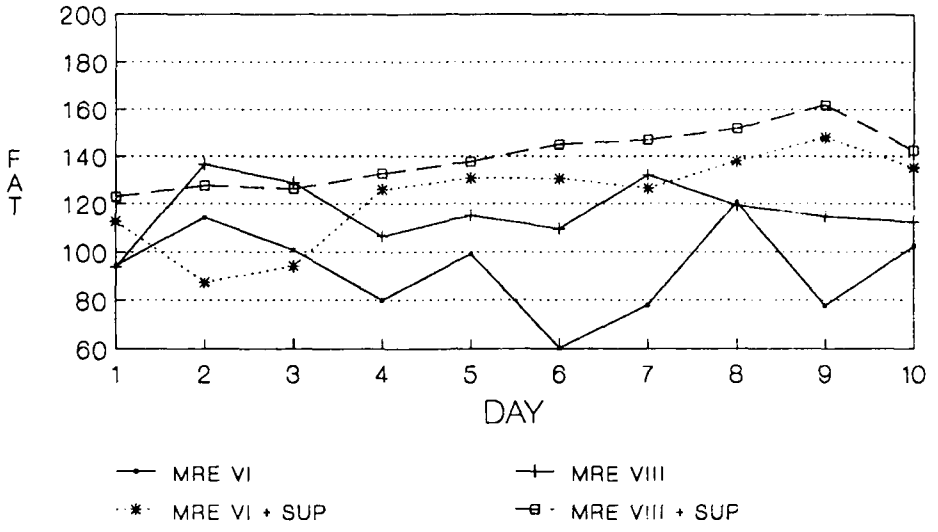


Figure 7
Total Daily CHO Consumption (g)

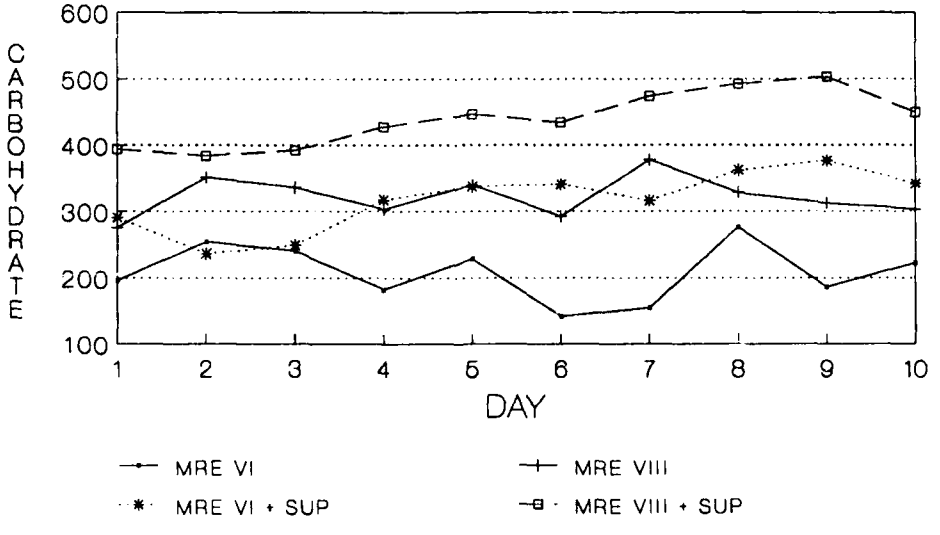


Figure 8
Mean Daily Energy Consumption (kcal)

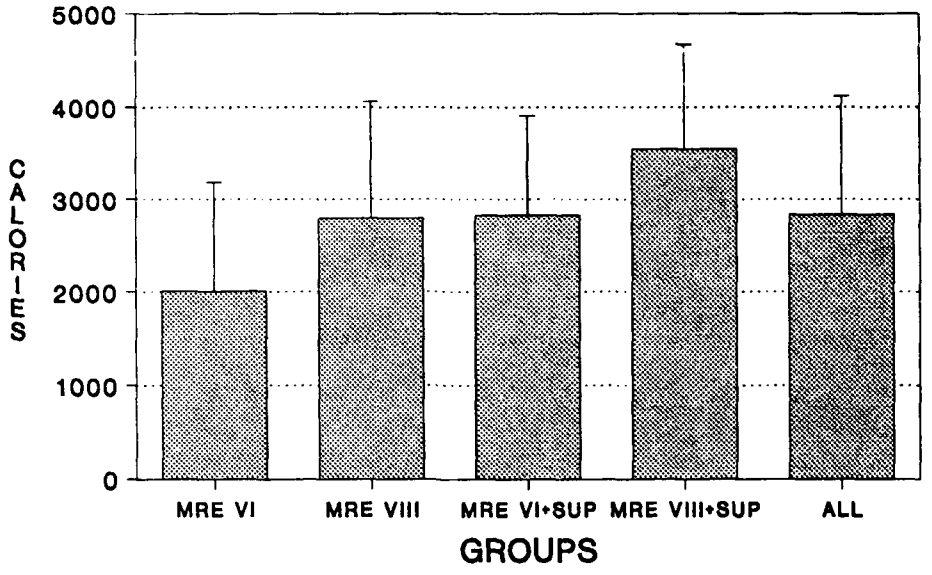


Figure 9
Mean Daily Protein Consumption (g)

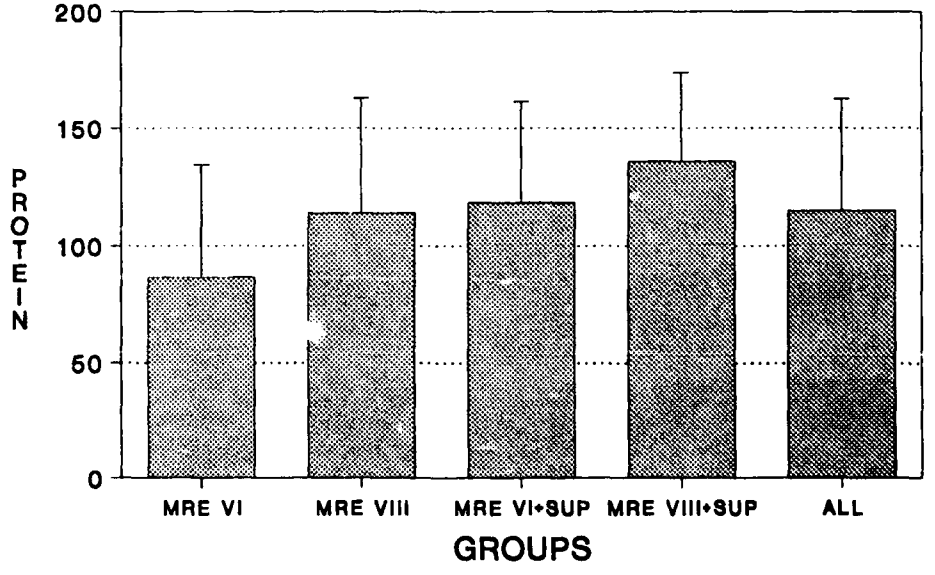


Figure 10
Mean Daily Fat Consumption (g)

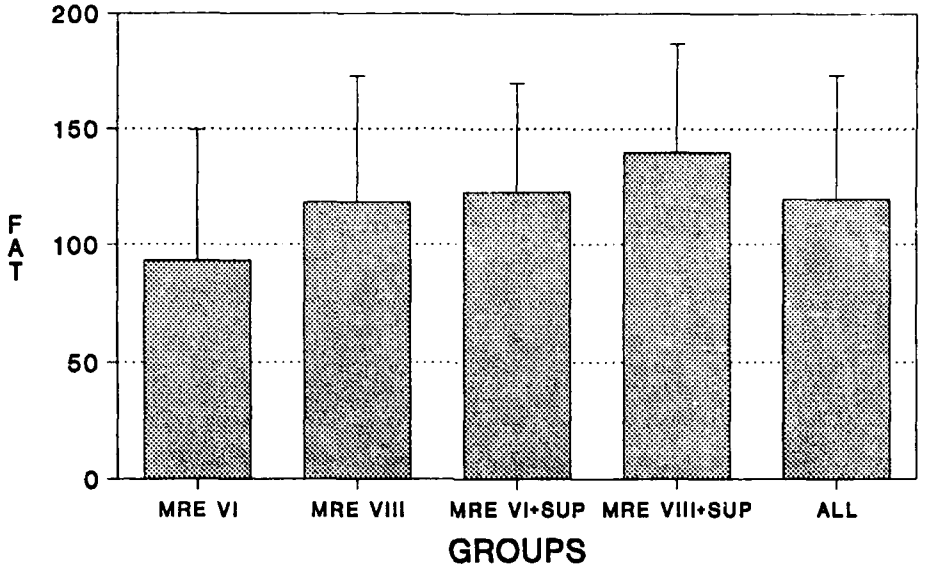


Figure 11
Mean Daily CHO Consumption (g)

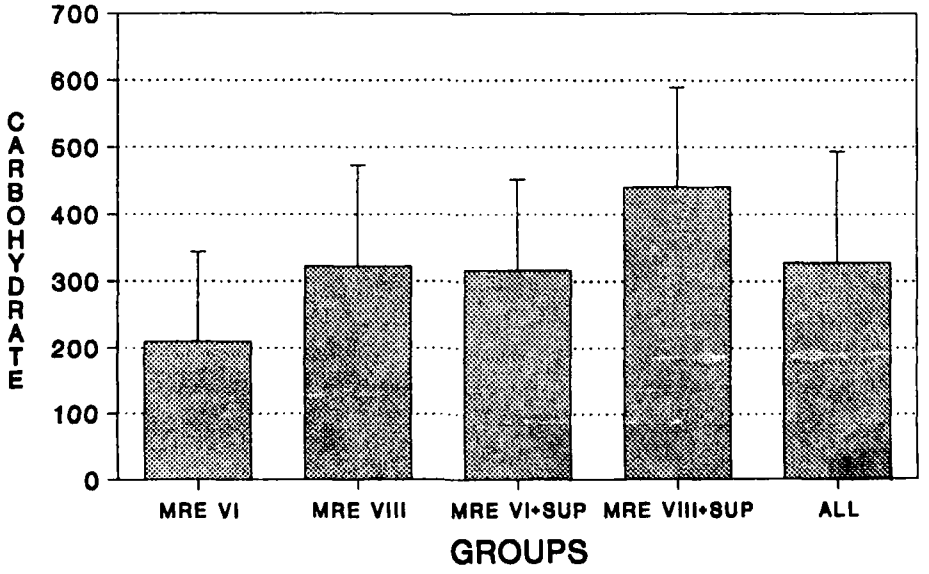


Figure 12
Mean Daily Thiamin Consumption
Expressed as a Percentage of the MRDA

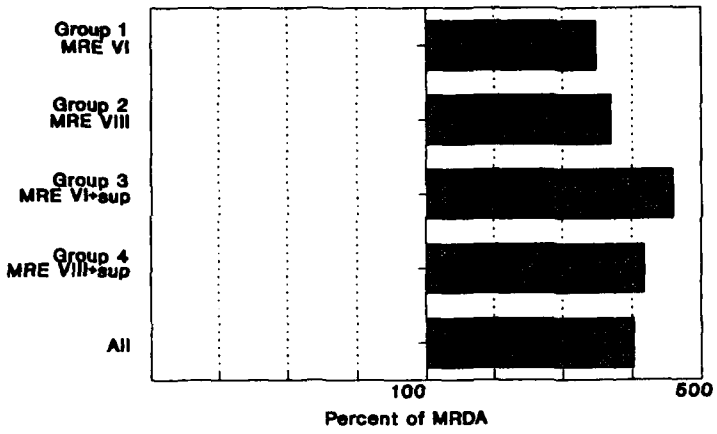


Figure 13
Mean Daily Riboflavin Consumption
Expressed as a Percentage of the MRDA

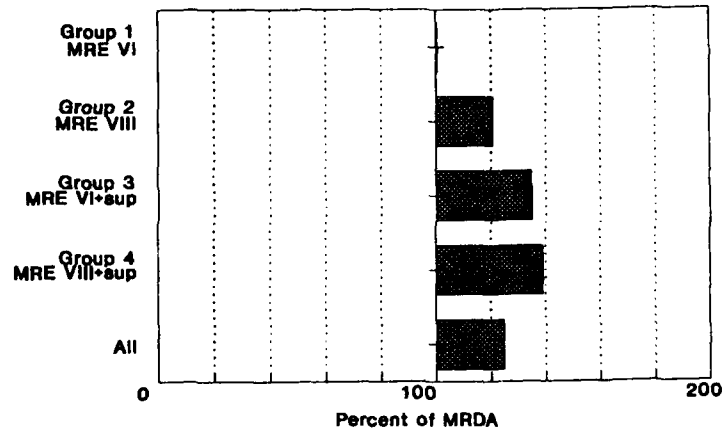


Figure 14
Mean Daily Niacin Consumption
Expressed as a Percentage of the MRDA

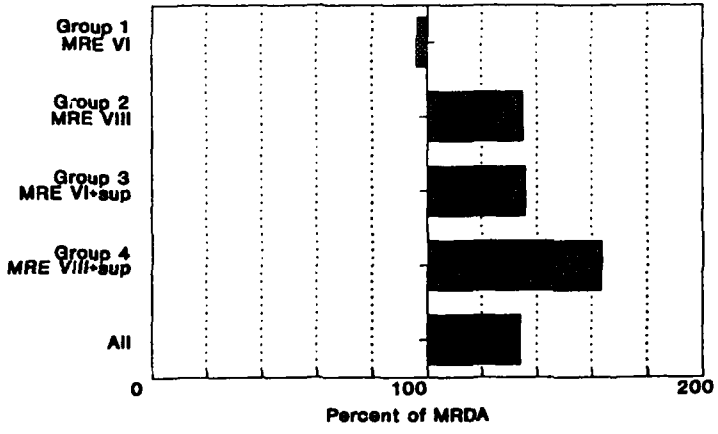


Figure 15
Mean Daily Vitamin B6 Consumption
Expressed as a Percentage of the MRDA

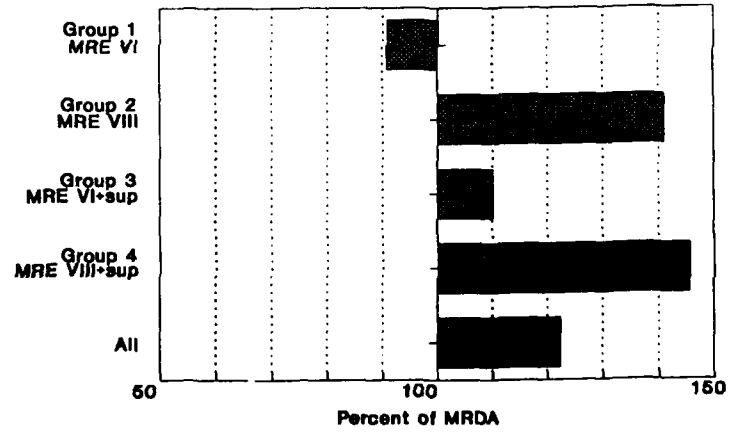


Figure 16
Mean Daily Folacin Consumption
Expressed as a Percentage of the MRDA

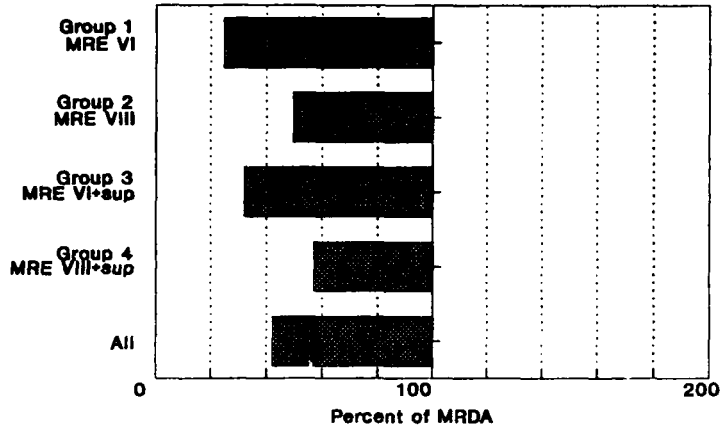


Figure 17
Mean Daily Vitamin B12 Consumption
Expressed as a Percentage of the MRDA

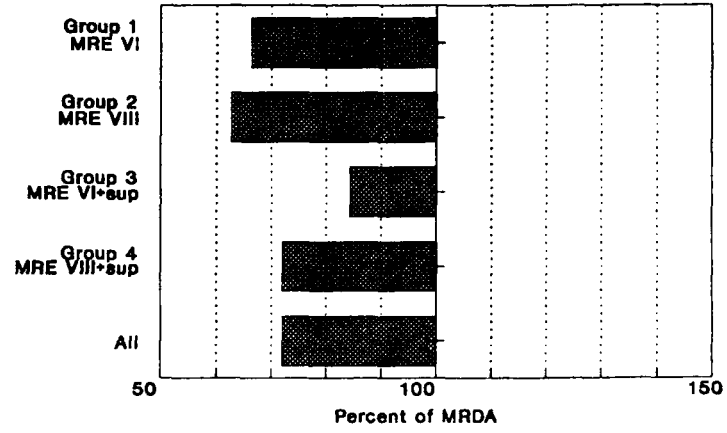


Figure 18
Mean Daily Vitamin A Consumption
Expressed as a Percentage of the MRDA

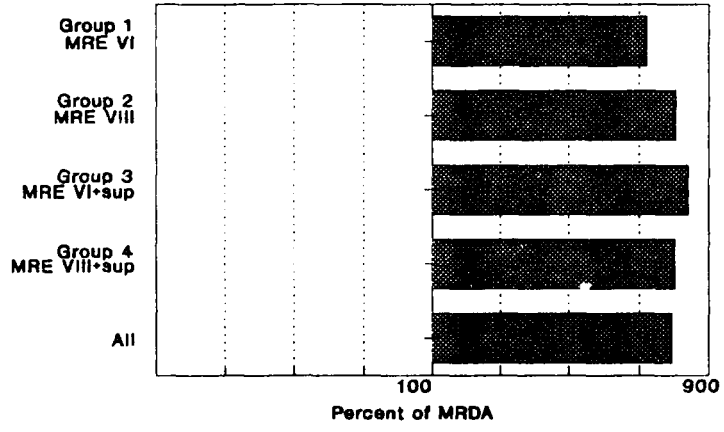


Figure 19
Mean Daily Vitamin E Consumption
Expressed as a Percentage of the MRDA

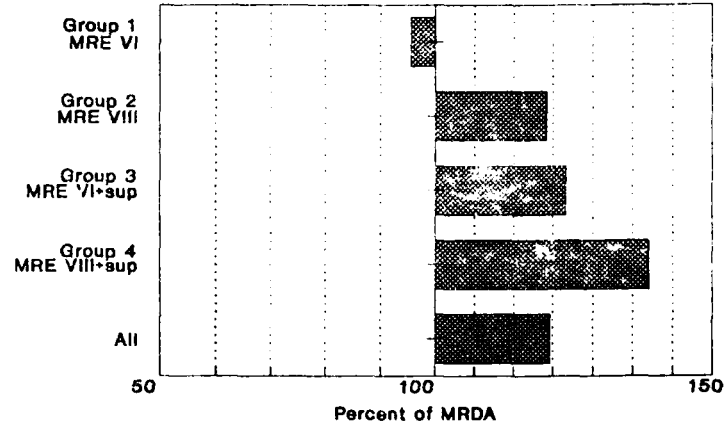


Figure 20
Mean Daily Ascorbic Acid Consumption
Expressed as a Percentage of the MRDA

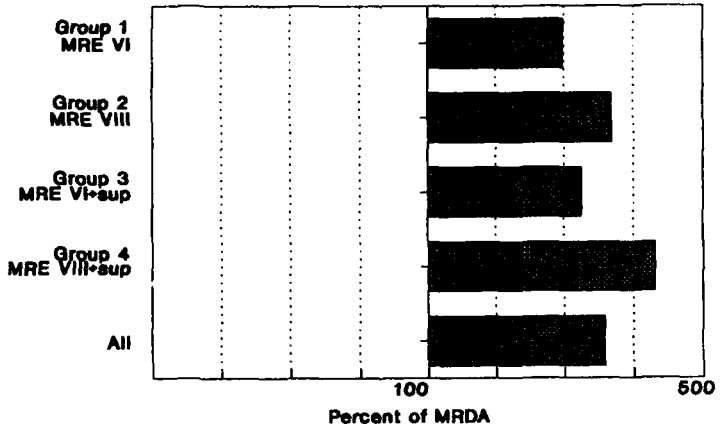


Figure 21
Mean Daily Calcium Consumption
Expressed as a Percentage of the MRDA

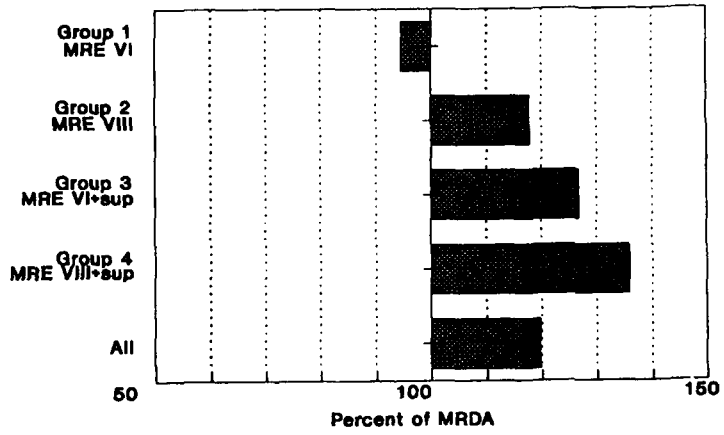


Figure 22
Mean Daily Iron Consumption
Expressed as a Percentage of the MRDA

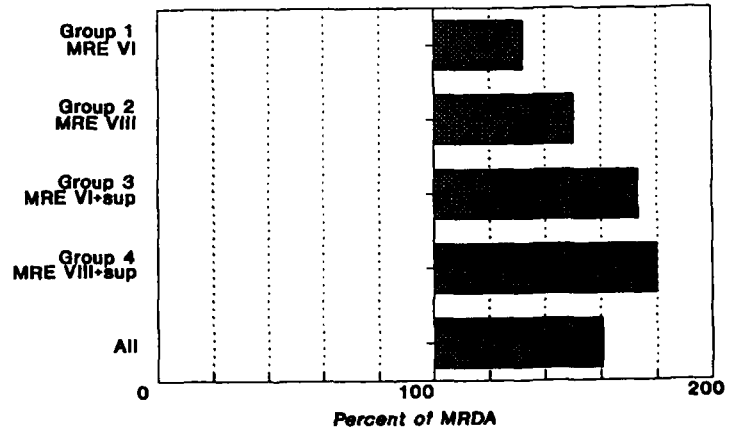


Figure 23
Mean Daily Sodium Consumption Expressed as a Percentage of the MRDA

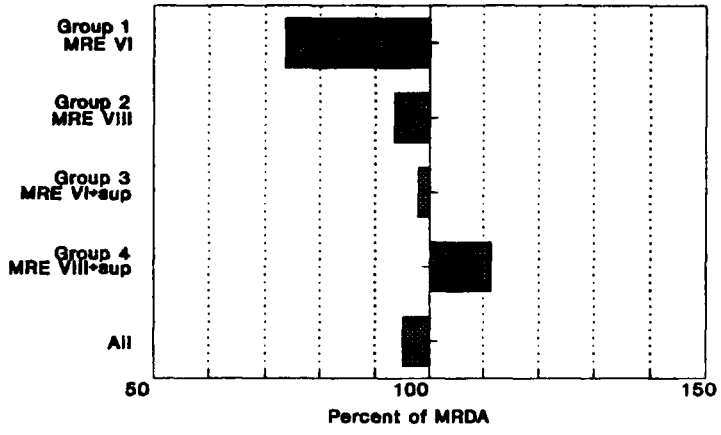


Figure 24
Mean Daily Zinc Consumption Expressed as a Percentage of the MRDA

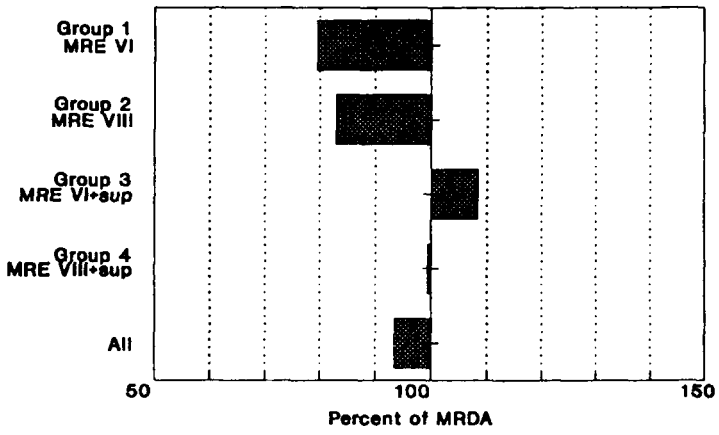


Figure 25
Mean Daily Phosphorus Consumption Expressed as a Percentage of the MRDA

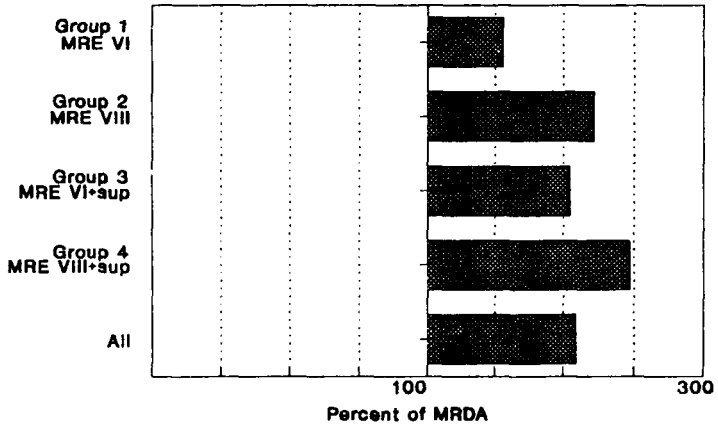


Figure 26
Mean Daily Magnesium Consumption Expressed as a Percentage of the MRDA

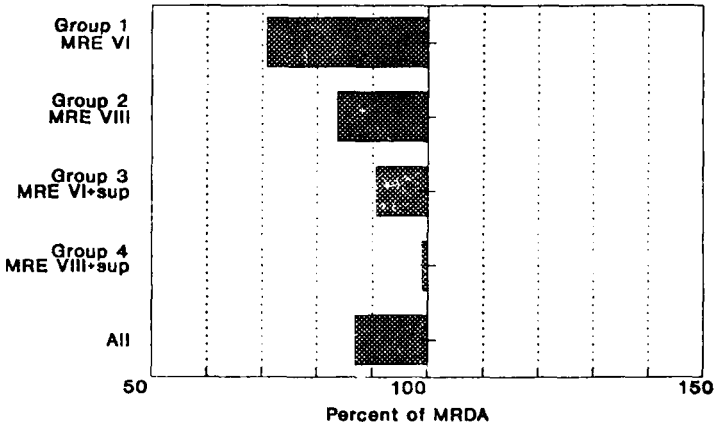


Table 11. Groups Where Consumption of Calories, Protein, Fat and Carbohydrate were Significantly Different at 0.05 Level.

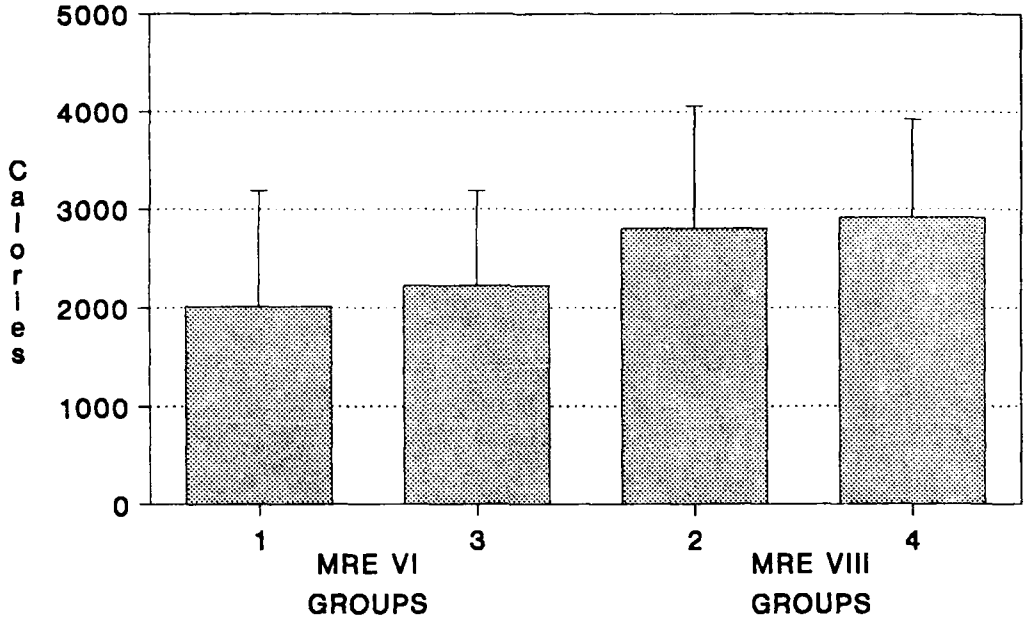
	MRE VI	MRE VIII	MRE VI + Supplement
MRE VIII	kcal protein fat carbohydrate	XXXXXX	XXXXXX
MRE VI + Supplement	kcal protein fat carbohydrate	Not Significant	XXXXXX
MRE VIII + Supplement	kcal protein fat carbohydrate	kcal protein fat carbohydrate	kcal protein fat carbohydrate

The consumption of micro nutrients tended to follow a similar pattern to the macro nutrients. Of B vitamins, thiamin, riboflavin, met and exceeded the MRDA, niacin and B6 met the MRDA in all except group 1, while folacin and B12 in all cases failed to do so. Vitamin A and ascorbic acid met the MRDA and vitamin E with the exception of group 1 did the same.

Of the minerals, iron and phosphorus, and with the exception of calcium for group 1, met the MRDA; with zinc and magnesium, all groups except group 3 for zinc failed to meet the MRDA. Sodium must be considered in a different category in that the MRDA should be regarded as the upper rather that the ideal level and not to have reached this goal, particularly in this type of environment may not be detrimental.

Although the supplemented groups consumed more, it is important from the viewpoint of this trial to establish whether or not this was at the expense of, or in addition to, the MRE. In order to establish this, mean daily energy intakes provided only by the MRE have been calculated. The results are presented in Figure 27.

Figure 27
Mean Daily Energy (kcal) Provided Only by the Meal Ready to Eat



It can be seen from this, in so far as Calories are concerned, that 215 kcal or 11% more of MRE VI and 111 kcal or 4% more of MRE VIII were consumed by the supplemented groups. Significant differences are presented in Table 12.

Table 12. *Groups Where Consumption of Calories were* Significantly Different at 0.05 Level.

	MRE VI	MRE VI + Supplement
MRE VIII	kcal	kcal
MRE VIII + Supplement	kcal	kcal

It is clear from these results that not only does food consumption increase in the supplemented groups but that this consumption can in part be attributed to the supplemental pack and in part to consumption of more of the MRE. Therefore, the concern that provision of the supplemental pack would cause soldiers to eat less of the MRE is not supported.

Acceptability of the Rations

Each subject received either the MRE VI, the MRE VIII, the MRE VI plus a supplemental pack, or the MRE VIII plus a supplemental pack as his sole source of food during the field exercise and rated the acceptability of each food item on a daily basis using the Dietary Logs. Overall acceptability ratings of the foods as well as other aspects of the rations were rated on a final questionnaire (see Appendix G) which was administered on the last day of the exercise.

Summaries of the acceptability data collected both in the field and from the final questionnaire are included in this report. The two sets of data were quite similar. For purposes of discussion, the presentation of the data will focus on subjects' impressions of the rations as assessed by the final questionnaire. A brief summary of the field data will be given in a later section of this report.

Final Questionnaire

MRE VI and MRE VIII

Table 13 summarizes mean acceptability ratings of individual food items for MRE VI and MRE VI with the supplement; Table 14 shows the acceptability ratings for MRE VIII and MRE VIII with the supplement. Subjects rated each food and beverage on a 9-point hedonic scale where 1 corresponds to "dislike extremely", 5 corresponds to "neither like nor dislike", and 9 corresponds to "like extremely." These tables also include results of comparison tests of the control group (those who did not receive the supplemental pack with their MRE) versus the supplemented group ratings. These tests were done to determine if including the supplemental pack with the MRE enhanced the acceptability of the standard MRE items.

The MRE VI generally received neutral ratings. Eight of the 14 entrees were liked moderately. The entrees that were liked the most were pork sausage patties, ham slices and frankfurters. The other six entrees were not well-liked by subjects. The spreads and the fruit items received more favorable ratings, particularly the cheese spread and the applesauce. The desserts received neutral ratings, with the exception of the chocolate items which were well-liked. For the MRE VI, there were generally no differences in the acceptability ratings between the two groups (control vs. supplement). The two items for which there were differences were actually rated higher by the control group.

Table 13. Mean Hedonic Ratings From the Final Questionnaire*
MRE VI – Control vs. Supplemented Groups.

	MRE VI	MRE VI Plus	t-Test Results
BEEF WITH BBQ SAUCE	4.35 (.46)**	3.29 (.52)	NS
BEEF WITH GRAVY	3.77 (.42)	4.15 (.51)	NS
BEEF WITH SPICED SAUCE	4.39 (.41)	3.44 (.49)	NS
BEEF STEAK	4.50 (1.2)	4.67 (2.3)	NS
BEEF PATTIES	6.31 (.45)	5.92 (.46)	NS
BEEF STEW	5.62 (.35)	6.57 (.36)	NS
CHICKEN ALA KING	5.31 (.45)	6.20 (.41)	NS
FRANKFURTERS	6.56 (.37)	5.93 (.44)	NS
CHICKEN LOAF	4.28 (.61)	3.32 (.59)	NS
HAM/CHICKEN LOAF	4.38 (.51)	3.90 (.52)	NS
HAM SLICES	6.60 (.39)	6.48 (.47)	NS
MEATBALLS WITH WITH BBQ SAUCE	5.88 (.41)	4.00 (.66)	$t = 2.56$, $p < 0.05$
PORK SAUSAGE PATTIES	6.85 (.47)	6.09 (.51)	NS
TURKEY WITH GRAVY	6.39 (.60)	4.88 (.53)	NS
CRACKERS	6.97 (.26)	6.93 (.32)	NS
BEANS WITH TOMATO SAUCE	4.85 (.46)	4.77 (.52)	NS
POTATO PATTY	5.67 (.65)	5.17 (.37)	NS
CHEESE SPREAD	7.20 (.33)	6.83 (.38)	NS
PEANUT BUTTER	6.85 (.31)	6.97 (.42)	NS
JELLY	6.88 (.37)	6.86 (.45)	NS
APPLESAUCE	8.18 (.19)	8.14 (.22)	NS
FRUIT MIX	6.56 (.40)	6.04 (.50)	NS
PEACHES	6.12 (.52)	5.96 (.54)	NS
STRAWBERRY	6.23 (.83)	6.56 (1.0)	NS
PEARS	6.43 (.49)	6.08 (.55)	NS
PINEAPPLE	4.29 (1.2)	6.40 (1.5)	NS
BROWNIE	5.57 (.51)	5.59 (.54)	NS
CHERRY NUT CAKE	5.34 (.56)	5.19 (.66)	NS
CHOC. COVERED COOKIE	7.91 (.34)	7.67 (.32)	NS
FRUITCAKE	4.10 (.59)	3.93 (.61)	NS
MAPLE NUT CAKE	5.92 (.67)	4.58 (.76)	NS
ORANGE NUT CAKE	4.46 (.58)	3.68 (.62)	NS
CHOCOLATE NUT CAKE	7.12 (.54)	4.53 (.69)	$t = 2.93$, $p < 0.01$
PINEAPPLE NUT CAKE	5.36 (.86)	3.00 (.96)	NS
COCOA	7.91 (.24)	8.10 (.26)	NS
COFFEE	6.77 (.44)	6.30 (.59)	NS
CREAM SUBSTITUTE	6.43 (.51)	6.71 (.54)	NS
CATSUP	4.76 (.49)	5.78 (.41)	NS
SOUP/GRAVY BASE	6.85 (.40)	5.65 (.46)	NS
CHOCOLATE FUDGE BAR	6.75 (.50)	6.65 (.59)	NS
CARAMEL	6.80 (.49)	7.10 (.46)	NS
VANILLA FUDGE	6.04 (.59)	6.53 (.69)	NS
STARCH JELLY BAR	4.29 (1.3)	6.00 (2.5)	NS
CHOCOLATE TOFFEE BAR	7.29 (.51)	6.00 (.68)	NS
CHOCOLATE ALMOND BAR	5.33 (1.3)	5.60 (1.7)	NS

* Rating Scale: 1 = Dislike Extremely ... 5 = Neither Like Nor Dislike ... 9 = Like Extremely

** Number in parentheses are standard errors.

Table 14. Mean Hedonic Ratings From the Final Questionnaire*
MRE VIII - Control vs. Supplemented Groups.

	MRE VIII	MRE VIII Plus	t-Test Results
PORK W/ RICE & BBQ SAUCE	6.07 (.48)**	7.35 (.33)	t = -2.25, p < 0.05
CORNED BEEF HASH	6.74 (.40)	6.97 (.42)	NS
CHICKEN STEW	6.97 (.30)	7.56 (.23)	NS
OMELET WITH HAM	7.25 (.32)	7.47 (.27)	NS
SPAGHETTI W/ MEAT SAUCE	7.76 (.24)	7.91 (.28)	NS
CHICKEN ALA KING	4.91 (.41)	5.33 (.45)	NS
BEEF STEW	6.29 (.32)	5.94 (.45)	NS
HAM SLICE	6.83 (.27)	7.42 (.28)	NS
MEATBALLS W/RICE & SAUCE	6.00 (.43)	7.79 (.30)	t = -3.42, p = 0.001
TUNA WITH NOODLES	6.86 (.36)	8.00 (.33)	t = -2.30, p < 0.05
CHICKEN AND RICE	7.03 (.36)	8.30 (.19)	t = -3.14, p < 0.01
ESCALLOPED POTATOES W/HAM	7.26 (.31)	7.91 (.26)	NS
CRACKERS	7.53 (.26)	7.42 (.31)	NS
POTATOES AU GRATIN	7.17 (.40)	7.26 (.40)	NS
CHEESE SPREAD	7.24 (.33)	7.50 (.30)	NS
JELLY	7.08 (.34)	7.17 (.33)	NS
PEANUT BUTTER	7.44 (.32)	7.17 (.35)	NS
APPLESAUCE	8.11 (.27)	8.20 (.26)	NS
FRUIT MIX	6.36 (.40)	6.18 (.39)	NS
PEACHES	6.16 (.41)	6.59 (.35)	NS
PEARS	6.32 (.38)	6.06 (.38)	NS
STRAWBERRIES	8.39 (.23)	8.13 (.34)	NS
BROWNIE	6.38 (.40)	6.75 (.44)	NS
CHERRY NUT CAKE	7.08 (.34)	6.97 (.41)	NS
CHOC. COVERED COOKIE	7.92 (.26)	8.50 (.18)	NS
MAPLE NUT CAKE	6.91 (.40)	6.69 (.47)	NS
OATMEAL COOKIE BAR	7.74 (.32)	7.69 (.44)	NS
CHOCOLATE NUT CAKE	8.22 (.22)	8.63 (.14)	NS
GRAPE BEVERAGE	7.50 (.33)	7.86 (.23)	NS
ORANGE BEVERAGE	7.19 (.35)	7.66 (.27)	NS
LEMON-LIME BEVERAGE	7.42 (.28)	6.40 (.42)	t = 2.00, p = 0.05
CHERRY BEVERAGE	7.85 (.23)	8.40 (.19)	NS
COCOA	8.24 (.20)	8.37 (.17)	NS
COFFEE	7.24 (.39)	6.86 (.45)	NS
TOOTSIE ROLL	8.29 (.36)	7.67 (1.3)	NS
CHARMS	7.42 (.35)	8.29 (.21)	t = -2.15, p < 0.05
M & M'S	8.46 (.26)	8.79 (.13)	NS
CARAMEL	8.19 (.18)	8.61 (.15)	NS
GUM	7.56 (.25)	7.94 (.22)	NS
HOT SAUCE	7.03 (.37)	7.62 (.39)	NS
CREAM SUBSTITUTE	7.14 (.38)	7.75 (.31)	NS
SUGAR	7.65 (.30)	7.53 (.36)	NS
SALT	6.79 (.43)	6.60 (.49)	NS

* Rating Scale: 1 = Dislike Extremely ... 5 = Neither Like Nor Dislike ... 9 = Like Extremely

** Number in parentheses are standard errors.

The MRE VIII items were rated considerably higher on acceptability than the MRE VI items. With the exception of chicken ala king, all items were liked at least slightly, on average. The entrees that were liked the most were spaghetti with meat sauce, omelet with ham, chicken and rice, and escalloped potatoes with ham. The spreads and the desserts were well-liked; the commercial candy received particularly high ratings. The flavored beverages were very acceptable as well.

In general, for the MRE VIII, there were no major differences between the control and the supplemented groups. However, several of the entrees were rated significantly higher by the supplemented group. One possible reason for these differences may have been the inclusion of pouched bread with the supplement. Being able to eat the entrees with bread may have increased their palatability. The Charms candy was also rated significantly higher by the MRE VIII supplement group than by the MRE VIII control group. A halo effect may have caused the entrees and the Charms to be rated higher by the supplemented group than by the control group. The supplement items received very high ratings which may have influenced the ratings of the standard MRE items.

It would appear that the acceptability ratings for the MRE VIII were higher than the ratings for the MRE VI which may be a reflection of subjects' opinions about various aspects of the MRE, such as taste, appearance, the amount of food in each meal, variety, and their opinions about eating the MRE for breakfast, lunch and dinner. Subjects' ratings of these factors are summarized in Table 15. Post-hoc comparisons using the Student-Newman-Keuls method indicated that subjects in both MRE VIII groups (control and supplement) were more satisfied with each of these aspects of the MRE than were subjects from either of the MRE VI groups. These findings are consistent with the results of an earlier evaluation which compared the Improved MRE (very similar to the MRE VIII), the MRE VII and the MRE IV (6) as well as with the results of an MRE VIII evaluation (11).

Table 15. Mean Hedonic Ratings of Various Aspects of the MRE by Group.*

	MRE VI	MRE VIII	MRE VI Plus	MRE VIII Plus	ANOVA Results
How the Food Tastes	5.31 (.30)**	6.92 (.23)	5.13 (.41)	7.69 (.15)	F = 20.1 p<0.001
How the Food Looks	5.06 (.29)	6.24 (.25)	4.77 (.32)	6.86 (.22)	F = 13.2 p<0.001
The Amount of Food in One MRE	3.56 (.31)	4.44 (.37)	3.97 (.42)	5.03 (.36)	F = 3.02 p<0.05
Variety Meal to Meal	3.54 (.29)	4.89 (.38)	3.00 (.37)	6.33 (.32)	F = 19.0 p<0.001
Eating the MRE for Breakfast	3.89 (.32)	5.40 (.36)	4.00 (.41)	5.97 (.39)	F = 7.91 p<0.001
Eating the MRE for Lunch	5.00 (.27)	6.54 (.27)	5.17 (.35)	7.14 (.28)	F = 13.1 p<0.001
Eating the MRE for Dinner	5.09 (.30)	6.71 (.27)	5.33 (.39)	7.14 (.29)	F = 10.6 p<0.001

* Rating Scale: 1 = Dislike Extremely ... 5 = Neither Like Nor Dislike ... 9 = Like Extremely

** Number in parentheses are standard errors.

The Supplemental Pack

Each of the items in the supplemental pack was well-liked by soldiers in the MRE VI and MRE VIII supplemented groups. Results of acceptability ratings from the final questionnaire and comparison tests are summarized in Table 16.

Table 16. Mean Hedonic Ratings of the Supplemental Pack Items*
Final Questionnaire - MRE VI Group vs. MRE VIII Group.

	MRE VI Group	MRE VIII Group	T-Test Results
Pouched Bread	8.59 (.18)**	8.86 (.09)	NS
Cold Beverage Powder	7.96 (.24)	8.17 (.21)	NS
Hot Pepper Sauce	6.67 (.57)	7.33 (.43)	NS
Charms	7.96 (.25)	8.53 (.16)	$t = -1.99$, $p = 0.05$
Beef Jerky	8.29 (.23)	8.89 (.07)	$t = -2.53$, $p < 0.05$
Raisin Nut Trail Mix	8.27 (.24)	7.50 (.33)	NS

* Rating Scale: 1 = Dislike Extremely ... 5 = Neither Like Nor Dislike ... 9 = Like Extremely

** Numbers in parentheses are standard errors.

Subjects in the MRE VIII group rated some of the supplement items significantly higher than subjects in the MRE VI group. Perhaps the high acceptability of the MRE VIII was generalized to this group's ratings of the supplement items, while the lower acceptability of the MRE VI, in turn, was generalized to the lower ratings of the supplement items by the MRE VI group.

Subjects felt that the portion size of the supplement items was slightly small, particularly for the bread, the beef jerky and the raisin nut trail mix. These results are summarized in Table 17. Satisfaction with the supplemental pack can be best demonstrated by the fact that almost all soldiers felt that each of the supplement items should be added to some, if not all, of the MRE meals.

Table 17. Mean Ratings of Portion Size of the Supplemental Pack Items* MRE VI Group vs. MRE VIII Group.

	MRE VI Group	MRE VIII Group	t-Test Results
Pouched Bread	2.77 (.21)**	2.42 (.20)	NS
Cold Beverage Powder	3.13 (.23)	3.36 (.17)	NS
Hot pepper Sauce	3.66 (.25)	3.83 (.22)	NS
Charms	3.50 (.20)	3.36 (.19)	NS
Beef Jerky	2.80 (.24)	2.50 (.20)	NS
Raisin Nut Trail Mix	2.77 (.28)	2.56 (.22)	NS

* Rating Scale: 1 = Much Too Small ... 4 = Just Right ... 7 = Much Too Large

** Numbers in parentheses are standard errors.

When asked how important they thought it was to include the supplemental pack with the MRE, subjects in both the MRE VI and the MRE VIII supplement groups responded that it was moderately important (the average rating was a 6 on a 7-point scale, where 7 corresponds to extremely important).

Field Data

The acceptability ratings given to food and beverage items in the MRE VI, MRE VIII, and supplemental pack during the field exercise are summarized in Tables H 1, H 2, and H 3 in Appendix H. Also included in these tables are the results of t-tests which compared the same ration groups with and without supplemental packs, as well as additional comparisons between the acceptability ratings of the supplemental pack when used by the MRE VI Plus group and the MRE VIII Plus group. Since the pattern of results from the field data is virtually identical to that described in detail for the final questionnaire data, field data results will be summarized in brief.

As in previous evaluations (6, 12), subjects' ratings of ration items tended to be somewhat higher when the food items were rated during consumption than when the items were rated from memory under post-test conditions. Table 18 lists the food items that received significantly different ratings in the field than on the final questionnaire.

As discussed earlier for the final questionnaire data, the addition of the supplemental pack enhanced the acceptability of MRE ration items in the field, but only when the supplemental pack was included with the well-liked MRE VIII. The supplemental items themselves were very well-liked, regardless of the ration to which they were added. However, several of the supplemental pack items were rated more favorably when included with the MRE VIII than when included with the MRE VI. As mentioned above, it seems that satisfaction with the MRE VIII items created a halo effect which increased the acceptability of the supplemental items.

Comparison of the MRE VI and the MRE VIII

In order to compare directly the acceptability of the MRE VI with and without the supplemental pack to the acceptability of the MRE VIII with and without the supplemental pack, the following three analyses were conducted.

The first analysis examined entree acceptability using a two-way analysis of variance with group (MRE VI, MRE VIII, MRE VI plus supplement, MRE VIII plus supplement) and Source of Data (field vs. final questionnaire) as factors. A mean of the acceptability ratings given to each of the entrees was computed for each subject, and each subject's overall rating for entrees was used for this analysis. These data are summarized in Table 19. The main effects for Group and Source of Data, as well as the Group X Source interaction were all significant at $p < 0.05$. Post-hoc comparisons (Student-Newman-Keuls) revealed several significant ($p < 0.05$) pairwise differences.

Table 18. Differences Between Field and Final Questionnaire Ratings.*

	Field Ratings	Final Questionnaire	Paired t-Test Results t	df	p
MRE VI					
Beef with Gravy	5.45 (.46)**	3.67 (.52)	6.39	17	<0.01
Beef w/Spiced Sauce	5.14 (.50)	4.23 (.43)	2.38	21	<0.05
Beef Stew	6.61 (.34)	5.96 (.39)	2.29	27	<0.05
Chicken ala King	6.34 (.39)	5.44 (.51)	2.51	24	<0.05
Beans with Tomato Sauce	5.91 (.43)	4.78 (.50)	2.94	26	<0.01
MRE VIII					
Pork w/Rice & BBQ Sauce	7.34 (.31)	6.15 (.65)	2.25	19	<0.05
Chicken ala King	6.92 (.34)	5.53 (.49)	2.60	16	<0.05
Beef Stew	7.48 (.27)	6.90 (.35)	2.28	19	<0.05
Strawberries	8.22 (.23)	8.69 (.15)	-2.77	15	<0.05
Chocolate Nut Cake	7.82 (.29)	8.52 (.24)	-2.08	22	<0.05
MRE VI Plus Supplement					
Beef with Gravy	5.97 (.50)	4.16 (.53)	4.48	24	<0.01
Beef w/Spiced Sauce	5.72 (.57)	3.68 (.57)	4.77	18	<0.01
Beef Patties	6.94 (.49)	6.21 (.56)	2.85	18	<0.05
Beef Stew	7.54 (.23)	6.57 (.36)	3.26	29	<0.01
Chicken ala King	6.95 (.33)	6.42 (.40)	2.55	25	<0.05
Ham/Chicken Loaf	5.86 (.50)	4.70 (.58)	3.61	22	<0.01
Beans with Tomato Sauce	6.13 (.44)	5.35 (.59)	2.78	22	<0.05
Cheese Spread	7.44 (.28)	6.90 (.39)	2.31	28	<0.05
Brownie	6.47 (.42)	5.77 (.53)	2.07	25	<0.05
Chicken ala King	6.98 (.39)	5.25 (.51)	4.81	27	<0.01
Beef Stew	7.74 (.35)	6.48 (.50)	3.10	22	<0.01
Cheese Spread	8.21 (.14)	7.50 (.31)	2.44	33	<0.05
Jelly	8.03 (.16)	7.38 (.29)	2.31	33	<0.05
Peanut Butter	7.93 (.29)	7.27 (.37)	2.34	29	<0.05
Fruit Mix	7.65 (.33)	6.29 (.40)	3.72	27	<0.01
Peaches	7.68 (.37)	6.83 (.43)	2.30	23	<0.05
Pears	7.40 (.43)	6.27 (.41)	3.08	25	<0.01
Fruit-Flavored Beverage	8.34 (.15)	7.62 (.21)	3.65	33	<0.01
Charms	8.65 (.15)	8.27 (.21)	2.23	32	<0.05

* Rating Scale: 1 = Dislike Extremely ... 5 = Neither Like Nor Dislike ... 9 = Like Extremely

** Number in parentheses are standard errors.

Table 19. Mean Hedonic Ratings of Entrees by Group.*

	Field Ratings	Final Questionnaire
MRE VI	6.34 (.21)**	5.92 (.25)
MRE VIII	7.33 (.18)	7.06 (.18)
MRE VI Plus Supplement	6.73 (.28)	5.80 (.31)
MRE VIII Plus Supplement	7.97 (.09)	7.52 (.14)

Group	$F(3, 123) = 16.5$, $p < 0.01$.
Source of Data	$F(1, 123) = 37.4$, $p < 0.01$.
Group x Source	$F(3, 123) = 2.76$, $p < 0.05$.

* Rating Scale: 1 = Dislike Extremely ... 5 = Neither Like Nor Dislike ... 9 = Like Extremely

** Numbers in parentheses are standard errors.

As previously mentioned, ratings given while eating the entree in the field were higher than those given on the final questionnaire. This is in agreement with the results of a previous evaluation (6). Also, the addition of the supplemental pack enhanced the acceptability of the entree, but only for the MRE VIII, the more preferred ration. Results of comparison tests between the MRE VI and the MRE VIII entrees, each with and without the supplement, statistically confirmed the apparent superiority of the MRE VIII. Even with the addition of the supplemental pack, the acceptability of the MRE VI entrees was significantly lower than the acceptability of the entrees as rated by the MRE VIII control group.

Fruit and dessert acceptability ratings were examined separately in analyses of variance similar to the entree acceptability analysis described above. Summary ratings for fruit and desserts can be found in Tables 20 and 21, respectively. The pattern of results from these analyses was very similar to that of the results of the entree analysis. Only the acceptability of the fruit items in the MRE VI tended to be improved by the addition of the supplemental pack.

Table 20. Mean Hedonic Ratings of Fruit by Group.*

	Field Ratings	Final Questionnaire
MRE VI	6.47 (.34)**	6.98 (.27)
MRE VIII	7.67 (.22)	7.59 (.29)
MRE VI Plus Supplement	7.34 (.25)	7.22 (.27)
MRE VIII Plus Supplement	7.90 (.22)	7.24 (.27)

Group	$F(3, 118) = 3.11$, $p < 0.05$.
Source of Data	$F(1, 118) = 0.45$, $p = 0.50$.
Group x Source	$F(3, 118) = 3.77$, $p < 0.05$.

* Rating Scale: 1 = Dislike Extremely ... 5 = Neither Like Nor Dislike ... 9 = Like Extremely

** Numbers in parentheses are standard errors.

Table 21. Mean Hedonic Ratings of Desserts by Group.*

	Field Ratings	Final Questionnaire
MRE VI	6.10 (.31)**	6.12 (.38)
MRE VIII	7.32 (.22)	7.69 (.23)
MRE VI Plus Supplement	6.39 (.29)	5.94 (.36)
MRE VIII Plus Supplement	7.98 (.16)	7.84 (.19)

Group	$F(3, 123) = 13.3$, $p < 0.01$.
Source of Data	$F(1, 123) = 0.25$, $p < 0.62$.
Group x Source	$F(3, 123) = 2.75$, $p < 0.05$.

* Rating Scale: 1 = Dislike Extremely ... 5 = Neither Like Nor Dislike ... 9 = Like Extremely

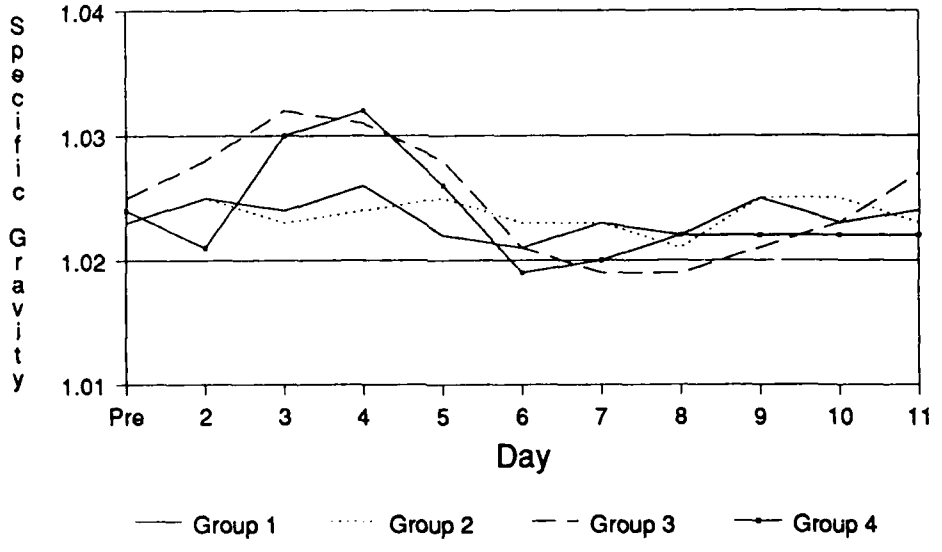
** Numbers in parentheses are standard errors.

Hydration Status

The state of hydration was inferred from measurements of specific gravity (SG) on the daily first void urine samples and from hematocrit measurements taken pre- and post-exercise. Increases in SG can reflect hypohydration, impending hypohydration, or renal adaptations to prevent hypohydration while changes in hematocrit reflect changes in circulating blood volume.

The mean values for urinary specific gravity for all groups are shown in Figure 28. A normal range for SG for an overnight urine for a well hydrated subject is 1.015 to 1.022. Values of 1.030 or greater are indicative of hypohydration (13).

Figure 28
Mean Daily Specific Gravity



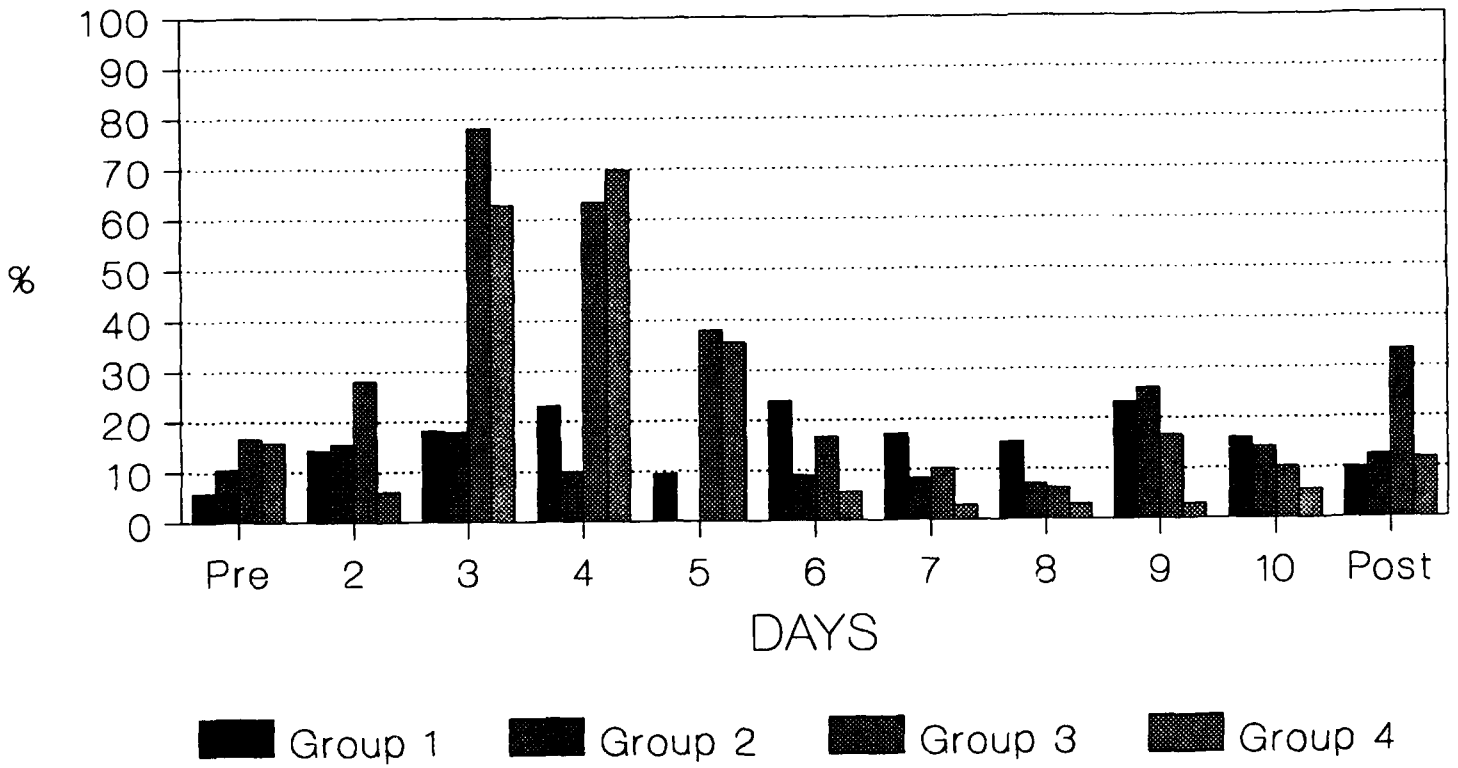
The daily measurement of urine SG allows a closer monitoring of the subjects and makes interventions more timely. The mean SG values shown in Figure 28 indicate that Groups 3 and 4 exceeded the limits (1.030) on the mornings of days 3 and 4. At that time, it was unclear why the soldiers were hypohydrated, and a positive intervention was ordered. The answer to the hypohydration is very clear when the water intake figures are examined. The advantage of the intervention was that more water was made available to the soldiers and forced drinking was possible. If water had not been made more available and forced drinking had not been instituted, the recovery would have been slower.

Figure 29 shows the percentage of soldiers in each group with SG values exceeding the limits (> 1.030) for each day of the study. The high incidence (> 60 %) on days 3 and 4 for Groups 3 and 4 indicates the widespread hypohydration which occurred when water was not available. On day 5 (after intervention), 35 % of the subjects in groups 3 and 4 still exceeded the limit. This occurred because SG values will decrease only when the deficit is made up and the ongoing needs are met. This recovery was speeded up with the forced drinking. It is clear that this episode of hypohydration was the result of supply problems and was in no way related to the consumption of the rations.

It has been reported that dehydration causes drowsiness, impatience, discomfort, weariness, irritability, reduced work efficiency, reduced cognitive ability, and reduced resistance to cold exposure (14, 15, 16). Without the ongoing daily testing, and the resultant positive intervention, the company might have ceased to be an effective force and would have been forced to stop and melt snow to increase water supplies. This episode shows the overall importance of: maintaining a viable water supply system, transporting water in an unfrozen state in an arctic environment, and the problems that can arise when the supply is compromised for any reason.

The hematocrit values for the pre- and post-samples for all groups were not significantly different. The lack of change in these values coupled with the values of the beginning and ending SG indicate that there was no overall change in hydration state during the study.

Figure 29
Percentage of Subjects Whose Urine Specific Gravity Equalled/Exceeded 1.030



Water Intake

The data for water intake (Figures 30, 31, 32, and 33) were obtained from the 24 hour Dietary Logs (Appendix F) and verified daily by interview.

The 6th ID (L) has an operational standard that each soldier should consume at least 4 liters of water per day. Water is usually supplied to the company units in 5 gallon containers (metal with ceramic liners or plastic). The source of the water is from a water buffalo which is filled with potable water from an approved supply point. In those cases when snow or ice is melted, the water must be purified with tablets. Since the use of individual stoves or squad heaters is minimized, the use of snow is also minimized. The snow in an extremely cold climate is very dry requiring approximately 10 volumes of snow to produce 1 volume of water. Water transported in 5 gallon containers in unheated vehicles it is usually delivered frozen and a container can require up to 8 hours beside a Yukon stove to thaw (time which is not available when troops are moving).

The water intake for each group is shown on a separate figure and consists of four parts: the water drunk, the water used for making beverages, the water used to hydrate food, and the sum of the components (total water). The mean value for each group for each day should be 4 liters. The data is presented as the number of canteens consumed and each canteen holds 960 ml when full. A simple conversion could produce a high value since a standard practice is to not fill the canteen full to allow for water movement to aid in retarding freezing.

Since the water supply was by company, Groups 1 and 2 should be similar and Groups 3 and 4 should be similar. In comparing Figures 30 and 31, it is apparent that the intakes are not the same with Group 2 averaging 4.23 canteens across the study while Group 1 averaged 3.13.

The data shown in Figures 32 and 33 for Groups 3 and 4 respectively indicates that water consumption was very uneven across the operation with the lowest consumption occurring on Day 3 and consisting of about 1 liter. This is only 25% of the water required by a 6th ID regulation and resulted in hypohydration of these troops. On day 4, positive intervention (forced drinking) was instituted and greater supplies of unfrozen water were made available and the problem of

Figure 30
Mean Daily Water Intake
Group 1 (MRE VI)

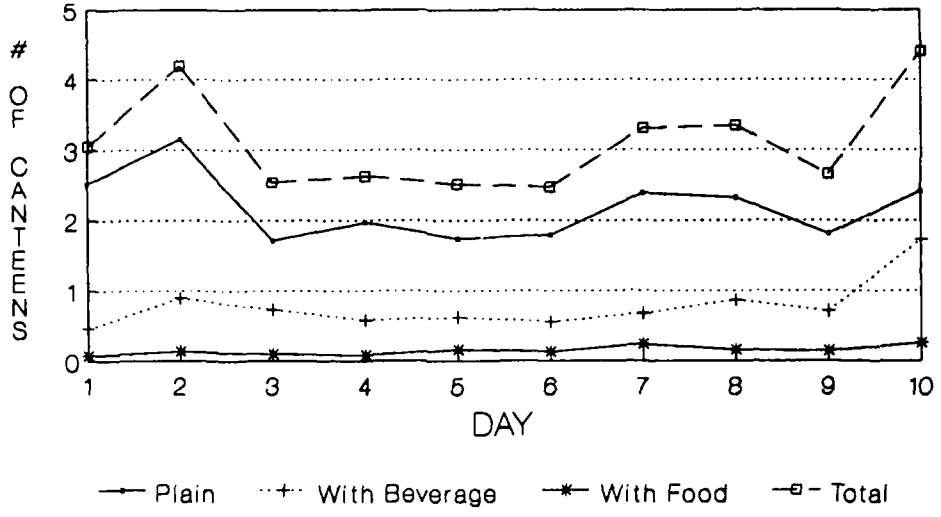


Figure 31
Mean Daily Water Intake
Group 2 (MRE VIII)

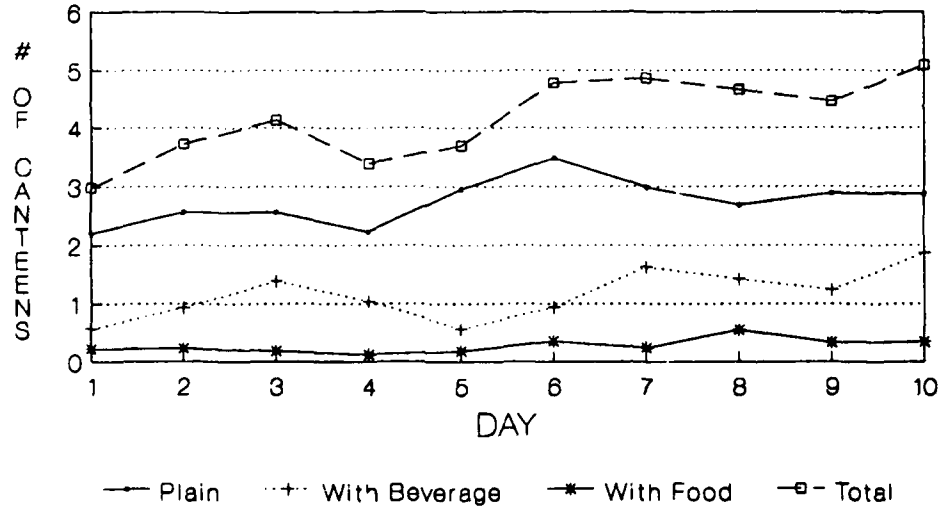


Figure 32
Mean Daily Water Intake
Group 3 (MRE VI + Supplement)

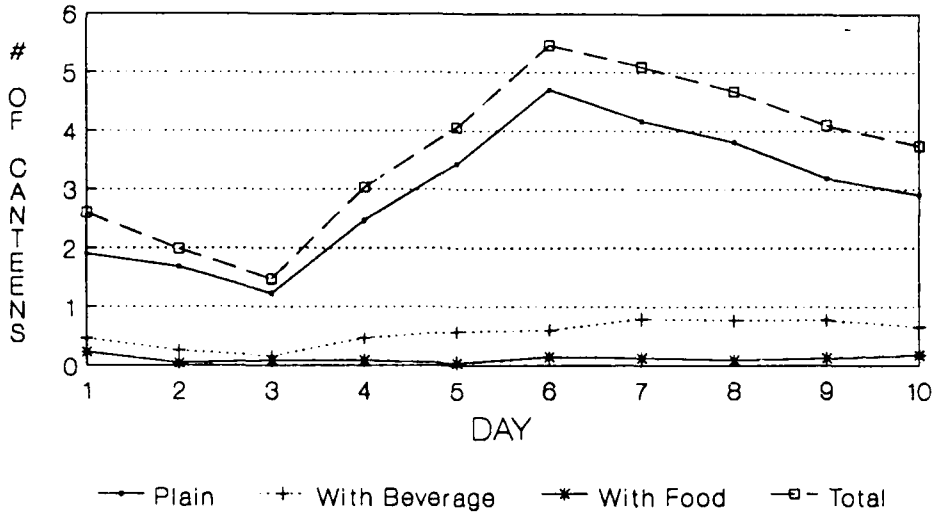
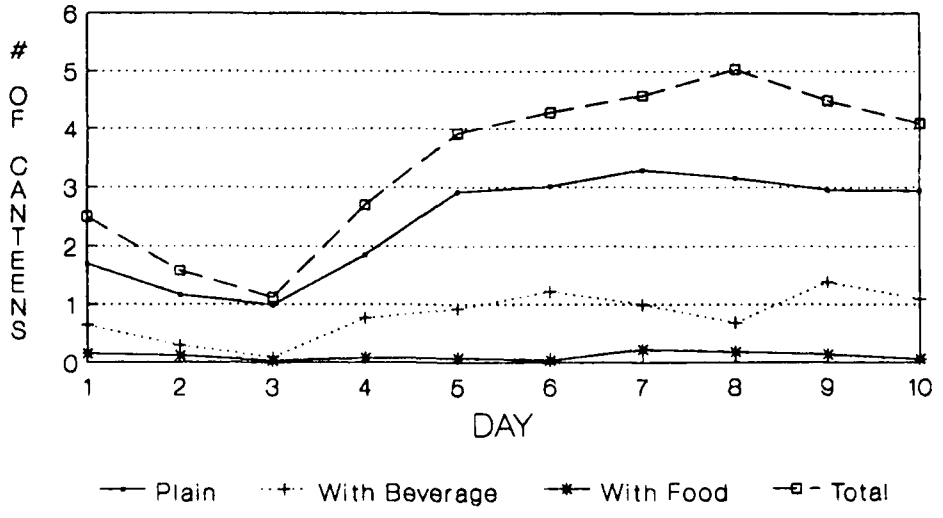


Figure 33
Mean Daily Water Intake
Group 4 (MRE VIII + Supplement)



inadequate water consumption was resolved. The average intake for Group 3 for the study was 3.61 canteens and 3.43 canteens for Group 4. There was a significant difference in the level of water intake between Group 2 and all other groups across the study, and a significant difference existed between companies on days 1 - 4. The water intake was similar for the two companies only when forced drinking was instituted and increased water supplies became available.

Ratings of Hunger and Thirst

On the final questionnaire, subjects rated how hungry and how thirsty they felt during the exercise. Frequency of feeling hungry and thirsty was rated on similar 7-point scales where 1 corresponds to "never", 3 corresponds to "sometimes" and 7 corresponds to "always". Mean ratings for all groups corresponded to sometimes/frequently hungry on the hunger scale. There were no significant differences among the groups.

Subjects' ratings of the portion size of the MRE (their only source of food) may partially explain their feelings of hunger during the exercise. These results are summarized in Table 22. The portion size for most categories of foods was rated as slightly small by all four ration groups. Subjects may have felt hungry because there simply wasn't enough food to eat. When asked why they did not eat enough during the exercise, about one third of all of the subjects responded that there was not enough food in the MRE. However, considering that there were from 4253 to 4816 kcal available to the soldiers and that they consumed 44 to 79% of the MRDA of 4500 kcal, this reason should be considered carefully.

Subjects gave some other reasons for not eating enough. Subjects in the MRE VI groups said they disliked the food in the MRE. Subjects in all groups indicated that there wasn't enough time to eat and that their MREs froze. Lack of variety was a reason for not eating enough for all groups except the MRE VIII plus supplement group.

Average ratings for frequency of feeling thirsty indicated that subjects were sometimes thirsty. There were no significant differences among the groups. Only 5 - 15% of subjects felt that they always drank enough during the exercise.

One reason that soldiers may have felt thirsty is that obtaining water during the exercise was somewhat difficult. Most subjects had problems with water freezing in their canteen. Other reasons that subjects gave for not drinking enough were that the water supply was often empty and there wasn't enough time to melt snow. Since eating and drinking are closely related events in both animals (17, 18, 19) and humans (20), the difficulty in obtaining water may have affected food consumption as well as fluid consumption.

Table 22. Mean Ratings of Portion Size of Each Meal Component by Group.*

	Group 1 MRE VI	Group 2 MRE VIII	Group 3 MRE VI + Supplement	Group 4 MRE VIII + Supplement	ANOVA Results
Entrees	2.69 (.16)**	2.92 (.13)	2.93 (.20)	3.06 (.15)	NS
Starches	3.46 (.14)	2.81 (.18)	3.20 (.22)	3.57 (.13)	$F = 4.24$ $p < 0.01$
Fruits	2.65 (.23)	2.88 (.19)	2.73 (.28)	3.17 (.20)	NS
Desserts	2.57 (.20)	2.73 (.14)	2.77 (.26)	2.89 (.17)	NS
Candy	2.47 (.21)	2.70 (.17)	2.90 (.27)	2.97 (.21)	NS
Cold Beverages	2.69 (.22)	3.14 (.17)	2.90 (.27)	3.31 (.22)	NS
Hot Beverages	2.66 (.22)	2.97 (.17)	2.77 (.27)	3.40 (.22)	NS
Seasonings	3.40 (.19)	3.39 (.22)	3.50 (.26)	4.00 (.13)	NS

* Rating Scale: 1 = Much Too Small ... 4 = Just Right ... 7 = Much Too Large

** Numbers in parentheses are standard errors.

SUMMARY AND CONCLUSIONS

In an Arctic environment where temperatures fell below $-40^{\circ}F$, the nutritional intake and acceptability of a proposed supplemental pack was assessed on a ten day exercise.

Four groups of soldiers, each approximately 35 strong with broadly similar sleep/wake patterns, were assessed; one group ate 4 MRE VIs daily, the second 3.5 MRE VIIIs, the third 3 MRE VIs and 1 supplemental pack and the fourth group 3 MRE VIIIs and 1 supplemental pack. Prior to deployment, initial measurements were taken. Thereafter, daily food intakes were reported using 24 hour Dietary Logs and hydration status ascertained from urine samples. At the end of the exercise further measurements were taken in order to ascertain what physiological changes had taken place since the start of the exercise.

This interim report addresses only those aspects of the methodology, results and discussion concerned with establishing whether or not the supplemental pack enhances the acceptability and nutritional intake derived from the older MRE VI.

The results obtained clearly demonstrate the success of the supplemental pack. Energy and nutritional intake were higher in the supplemented groups. Calorie intake was approximately 41 percent higher in the groups consuming MRE VI and approximately 27 percent higher in the groups consuming MRE VIII. When the effects of the supplemental pack are removed, energy intake was still 11 percent higher in the MRE VI and 4 percent higher in the MRE VIII group. The supplemental pack was consumed not instead of, but in addition to, the MRE. The supplemental pack items appeared to increase the intake of the MRE. There was no instance of a reduced vitamin or mineral intake attributable to the consumption of a supplemental pack along with the MRE. What is of some concern and needs to be addressed still further is the relatively low consumption of energy in all groups and the low consumption of certain vitamins and minerals in some groups when compared to the MRDAs. Calorie intake from the MRE ranged from 45 percent in the MRE VI to 79 percent in the MRE VIII supplemented group and failed to meet the test criteria. It accounted, in part, for body weight losses which varied from 4.8 lb to 3.0 lb. Even so, no losses exceeded the 3 percent criteria. Consumption of the remaining nutrients followed

broadly similar patterns.

In so far as acceptability is concerned, adding the supplemental pack to the MRE ration enhanced the acceptability of the MRE VIII but not the MRE VI. The supplemental pack items themselves were rated very favorably by the subjects in both the MRE VI and the MRE VIII groups and met the test criteria. However, subjects in all groups indicated that they did not have enough to eat, despite the fact that they failed to consume all of the ration. Subjects in the supplemented groups recommended increasing the portion size of the items included in the supplemental pack.

Hydration status and the consumption of water also need to be considered still further as the mean SG exceeded the test criteria on a number of consecutive days and was only reduced with the introduction of forced drinking. However, at this stage, it is not considered to be a problem associated with the ration or supplement but rather one of water discipline and logistics.

RECOMMENDATIONS

Adding the supplemental pack did not enhance the acceptability (as measured by the hedonic ratings) of the MRE VI. However, from the evidence provided during this trial, it did enhance the nutritional intake. In so far as the nutritional aspects are concerned, the supplemental pack was successful and should therefore be considered for purchase.

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APPENDIX A

A REVIEW OF THE SALIENT FEATURES AND CHANGES MADE TO THE MEAL-READY-TO-EAT

A REVIEW OF THE SALIENT FEATURES AND CHANGES MADE TO THE MEAL-READY-TO-EAT

MRE I-V	MRE VI	MRE VII	MRE VIII
12 Menus	12 Menus	12 Menus	12 Menus
			9 new Entrees including 2 Breakfast types
5 oz Entrees	5 oz Entrees (5 Menus) 8 oz Entrees (7 Menus)		8 oz Entrees (10 menus) 6 oz Omelet + 5 oz Potato au Gratin 4 1/4 oz Ham Slice + 5 oz Potato au Gratin
2 Dehydrated Entrees			
2 Dehydrated Potatoes	Potatoes deleted	Hot Pepper Sauce added to 3 menus	Hot Pepper Sauce added to 1 more menu
1 Wet Pack Fruit 4 Dehydrated Fruit	Dehydrated Fruit added to more menus		
2 Beverages Coffee Cocoa		Fruit Flavored Beverage added	
	Minor adjustments to cakes and cookies to maintain nutritional balance		Commercial Candies included
Mean Nutritive Value			
Energy 1223 kcal	1204 kcal	1354 kcal	1306 kcal
Protein 43.3g	50.6g	53.1g	48.6g
Fat 55.7g	54.1g	57.1g	51.9g
CHO 137.2g	128.8g	157.0g	161.2g

APPENDIX B

NUTRITIONAL CONTENTS OF THE PROPOSED SUPPLEMENTAL PACK

NUTRITIONAL CONTENTS OF THE PROPOSED SUPPLEMENTAL PACK

Nutrient	Unit	Supplemental Pack 1	Supplemental Pack 2
		70 gm Pouched Bread	Pouched Bread
		34 gm Beverage Base	Beverage Base
		5 gm Tabasco Sauce	Tabasco Sauce
		28 gm Candy (Charms)	Candy (Charms)
		43 gm Beef Jerky	57 gm Nuts & Raisins
Energy	kcal	661	821
Protein	gm	28.45	17.29
Fat	gm	17.54	27.87
Carbohydrate	gm	97.26	125.00
Vitamin A	mcg RE	0	0
Vitamin E	mg TE	2.43	3.4
Ascorbic Acid	mg	24.84	24.84
Thiamin	mg	0.41	0.48
Riboflavin	mg	0.28	0.17
Niacin	mg NE	5.80	4.36
Vitamin B6	mg	0	0.08
Folacin	mcg	15.9	33.39
Vitamin B12	mcg	0.6	0
Calcium	*mg*	61.34	95.98
Phosphorus	mg	290.6	224.3
Magnesium	mg	41.6	73.6
Iron	mg	4.12	1.93
Zinc	mg	4.18	1.47
Sodium	mg	1178	665

APPENDIX C

VOLUNTEER AGREEMENT AFFIDAVIT

VOLUNTEER AGREEMENT AFFIDAVIT

For use of this form, see AR 70-25; the proponent agency is OTSG

PRIVACY ACT OF 1974

Authority: 10 USC 3013, 44 USC 3101, and 10 USC 1071-1087.

Principle Purpose: To document voluntary participation in the Clinical Investigation and Research Program. SSN and home address will be used for identification and locating purposes.

Routine Uses: The SSN and home address will be used for identification and locating purposes. Information derived from the study will be used to document the study, implementation of medical programs, adjudication of claims, and for the mandatory reporting of medical conditions as required by law. Information may be furnished to Federal, State and local agencies.

Disclosure: The furnishing of your SSN and home address is mandatory and necessary to provide identification and to contact you if future information indicates that your health may be adversely affected. Failure to provide the information may preclude your voluntary participation in this investigational study.

PART A(1) - VOLUNTEER AFFIDAVIT

Volunteer Subjects in Approved Department of the Army Research Studies

Volunteers under the provisions of AR 40-38 and AR 70-25 are authorized all necessary medical care for injury or disease which is the proximate result of their participation in such studies.

I, _____, SSN _____.

having full capacity to consent and having attained my _____ birthday, do hereby volunteer/give consent as legal representative for _____ to participate in an evaluation of the Nutritional Intake and Acceptability of the MRE VI and VIII and the

(Research Study)

MRE VI and VIII with Supplements Consumed in a Cold Environment

under the direction of MAJ John S. A. Edwards

conducted at Fort Greely, Alaska

(Name of Institution)

The implications of my voluntary participation/consent as legal representative, duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

Contact telephone(s): AV 256-4979 commercial (508) 651-4979

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights/the rights of the person I represent on study-related injury, I may contact

Office of the Chief Counsel

U.S. Army Natick Research, Development and Engineering Center (508) 651-4322

(Name, Address and Phone Number of Hospital Duty Area Center)

I understand that I may at any time during the course of this study revoke my consent and withdraw/have the person I represent withdrawn from the study without further penalty or loss of benefits; however, I/the person I represent may be required (military volunteer) or requested (civilian volunteer) to undergo certain examination if, in the opinion of the attending physician, such examinations are necessary for my/the person I represent's health and well-being. My/the person I represent's refusal to participate will involve no penalty or loss of benefits to which I am/the person I represent is otherwise entitled.

_____

PART A (2) - ASSENT VOLUNTEER AFFIDAVIT (MINOR CHILD)

I, _____, SSN _____ having full capacity to consent and having attained my _____ birthday, do hereby volunteer for _____ to participate in _____

(Research Study)

under the direction of _____

conducted at _____

(Name of Institution)

(Continue on Reverse)

PART A(2) - ASSENT VOLUNTEER AFFIDAVIT (*MINOR CHILD*) (*Cont'd.*)

The implications of my voluntary participation; the nature, duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

_____

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights I may contact

_____

at _____

(*Name, Address, and Phone Number of Hospital Graduate Area Could*)

I understand that I may at any time during the course of this study revoke my assent and withdraw from the study without further penalty or loss of benefits; however, I may be requested to undergo certain examination if, in the opinion of the attending physician, such examinations are necessary for my health and well-being. My refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

_____

PART B - TO BE COMPLETED BY INVESTIGATOR

INSTRUCTIONS FOR ELEMENTS OF INFORMED CONSENT: (*Provide a detailed explanation in accordance with Appendix E, AR 40-38 or AR 70-25.*)

The purpose of this study is to assess the suitability and acceptability of the Meal Ready-to-Eat (MRE) and a supplemental pack eaten in a cold environment. The study will last for 14 days and will be conducted in conjunction with your normal cold weather military training except that you will only be given MREs to eat. You will not be permitted to supplement these rations by bringing your own food into the field.

Prior to the start of the exercise you will be weighed and your height measured, a small blood sample will be taken from a vein in your arm using a hypodermic type needle and you will be asked to give a sample of your urine and saliva. The amount of blood that we will draw will be less than three tablespoons. Trained personnel will be used although localized pain and a small bruise may occur. There is a slight chance of infection at the site although this is no greater than that experienced in a hospital. Measurements, similar to those taken in hospital to monitor your heart rate, may be taken by attaching sensors to your hand and foot and measuring the resistance. This is a widely used technique being both safe and painless. You may be asked to drink a small glass of modified water and you may also be asked to wear a lightweight activity monitor attached to your wrist. You will be asked to fill out daily food logs and you will receive training on how to do this. Urine samples will be collected daily.

I do ☐ do not ☐ (*check one & initial*) consent to the inclusion of this form in my outpatient medical treatment record.

SIGNATURE OF VOLUNTEER	DATE	SIGNATURE OF LEGAL GUARDIAN (*If volunteer is a minor*)
PERMANENT ADDRESS OF VOLUNTEER	TYPED NAME OF WITNESS	
	SIGNATURE OF WITNESS	DATE

REVERSE OF DA FORM 5303-R, MAY 88

PART B - TO BE COMPLETED BY INVESTIGATOR (cont'd)

At the end of the trial, a further blood sample (less than three tablespoons), saliva sample and weight will be taken, you may be asked to drink another small glass of modified water and measurements again taken using sensors attached to your hand and foot.

The blood sample will be analyzed to determine if any changes occur in your nutritional and hydration status during the course of this trial, while urine is required to establish whether or not you receive or drink sufficient water. The modified water will enable us to determine your energy expenditure and the activity monitor will measure the levels of activity between participating groups. The measurement obtained by attaching sensors to your body will enable us to determine your total body water.

You will be asked to answer questions about yourself, your background, medical history and past dietary patterns, habits and attitudes. This will assist us when analyzing the results. The information you give, together with the other information that we will collect, will be treated in the strictest confidence and will not be revealed to any person who is not authorized to receive it or has no need to know. However you should know that complete confidentiality cannot be promised, particularly to subjects who are military personnel, because information bearing on your health may be required to be revealed to appropriate medical or command authorities. Information about you may be inspected by the Institutional Review Boards for Human Studies, the Food and Drug Administration and officials of the US Army Research and Development Command.

You will be participating in a field exercise and consuming Meal Ready-to-Eat rations for 14 day as part of your regular Army activity. You will receive no direct benefit from participating in this study other than to know that you helped shape future changes in combat rations. Participation in this study is on a voluntary basis. If you choose not to take part or if you choose to withdraw from the study you will not be excused or withdrawn from the field. A decision to remove you from the field would be taken by your local senior military commander.

A second copy of this Agreement Form is provided here for your information and retention.

SIGNATURE OF VOLUNTEER	DATE SIGNED	SIGNATURE OF LEGAL GUARDIAN (If volunteer is a minor)	
PERMANENT ADDRESS OF VOLUNTEER	TYPED OR PRINTED NAME AND SIGNATURE OF WITNESS		DATE SIGNED

Reverse of DA FORM 8303-R.

APPENDIX D

A SUMMARY OF THE PROPOSED STUDY

Thank you for agreeing to participate in the evaluation of the MRE ration. Your opinions of the ration, good and bad, are needed so that changes and improvements can be made.

This handout is a summary of the main points of the verbal briefing for you to refer to if necessary.

The overall aims of the trial are to find out:

1. How much of the ration you consumed.
2. How well you liked each item.
3. How much water you drank.
4. What problems you had with the ration.
5. What your energy expenditure was during the exercise.

To meet the objectives of this study, you will not be allowed to bring "poggy bait".

Prior to deployment you will again meet as a group. This will be early in the morning, before breakfast. We will take a blood sample and a sample of your first urine of the morning. We will also measure your height and weight.

A smaller group (not all of you) will also drink a glass of modified water that contains a non-radioactive substance. We will allow time for the modified water you drink to mix with your body water (3 to 4 hours) and then we will collect samples of saliva and urine. An activity monitor will be attached to your wrist. You will wear the monitor for about 11 days.

Prior to deployment you will be given a colored card with a second (white) copy attached. The reason for the color is for the data collectors to tell the difference between groups. Record the food and water consumed over the next 24 hours on the colored card. The period covered by this card will be from 0900 hrs on the morning of deployment to 0900 hrs the following day. The data collectors will meet you the following day, take the card from you and give you a new card for the next 24 hours. If the data collectors cannot meet with you before the next 24 hour period starts, use the white copy to record food and water intakes until you meet up with the data collectors. Every 24 hours we will also require a sample of your urine. Ideally this should be the first urine of the morning and you will be given a small container in which to collect it.

You will be given a trash bag. Please put all the empty wrappers, partly eaten food and any other food items that you no longer want in the trash bag. We need your trash so that we can analyze the food you throw away. You will get a new trash bag each day.

After approximately 11 days in the field we will meet with you as a group for the last time. We will repeat the measurements made prior to deployment, ask you to fill out some questionnaires about the ration and then leave you alone.

It is going to be inconvenient and difficult at times, for us as well as you, but only with this kind of information can improvements be made to the existing rations.

Many thanks for your help.

APPENDIX E

PRE-MEASUREMENT RECORD CARD

NAME: _____ Rank: _____
(Last) (First) (Initial)

Do not write below this line

Height: _____

Weight: _____ Subject No. _____

Urine : _____ Group No. _____

Blood : _____

Sub Sample ONLY

BIA : _____

DL Water: _____

Saliva : _____

Activity Monitor: _____

NATICK Form 721 (ONE-TIME)
1 Dec 88

APPENDIX F

24 HOUR DIETARY LOGS

NAME: _____ GROUP No: _____ SUBJECT No: _____ DAY: _____ DATE : _____

FOODS EATEN

Please circle below the number that indicates how much of each item you ate today. If you ate an amount that is not listed, write it on the line to the right.
For example: If you ate 1/2 Chicken Stew Entrees circle 1/2.

All food items issued or traded should be accounted for in the columns below as AMOUNT EATEN, NOT EATEN/NOT FINISHED.

RATING OF FOOD

Please circle below the number that indicates how much you Liked or Disliked the ration items that you ate today.
For example: If you Liked the Chicken, Slightly circle 6.

REASONS FOR NOT EATING/FINISHING

Please write in the number of the MAIN REASON that you did not Eat or Finish any food.

1. Taste
2. Smell
3. Bland
4. Looks
5. Dieting
6. Full up
7. Traded
8. Saved
9. Too Cold
10. No Water
11. No Heat
12. No Time
13. Damaged
14. Frozen
15. Others

CODE	FOOD ITEM	AMOUNT EATEN						Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like/Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely	NOT EATEN/NOT FINISHED
	ENTREES																
1	Pork with Rice in BBQ Sauce	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
2	Corned Beef Hash	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
3	Chicken Stew	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
4	Omelet with Ham	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
5	Spaghetti, Meat & Sauce	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
6	Chicken a la King	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
7	Beef Stew	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
8	Ham Slice	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
9	Meatballs, Rice & Sauce	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
10	Tuna with Noodles	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
11	Chicken & Rice	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
12	Escalloped Potatoes with Ham	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
	STARCHES																
13	Potato au Gratin	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
14	Crackers	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
	SPREADS																
15	Cheese Spread	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
16	Jelly	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
17	Peanut Butter	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
	FRUIT																
18	Apple Sauce	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
19	Fruit Mix	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
20	Peaches	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
21	Strawberries	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
22	Pears	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
	DESSERT																
23	Chocolate Covered Brownie	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
24	Cherry Nut Cake	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
25	Chocolate Covered Cookie Bar	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
26	Chocolate Nut Cake	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
27	Maple Nut Cake	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
28	Oatmeal Cookie Bar	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
	BEVERAGES																
29	Beverage Base Powder	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
30	Cocoa Powder	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
31	Coffee	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
32	Cream Substitute	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
33	Sugar	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
	OTHERS																
34	Tootsie Roll	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
35	Charms	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
36	M & M	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
37	Caramel	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
38	Gum	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
39	Tabasco Sauce	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
40	Salt	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
41	_____	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
42	_____	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____

NATICK Form 719 (ONE-TIME)
1 Dec 88

FOODS EATEN

Please circle below the number that indicates how much of each item you ate today. If you ate an amount that is not listed, write it on the line to the right.
For example: If you ate 1/2 the Pouched Bread, circle 1/2.

All food items issued or traded should be accounted for in the columns below as AMOUNT EATEN, NOT EATEN/NOT FINISHED.

RATING OF FOOD

Please circle below the number that indicates how much you Liked or Disliked the ration items that you ate today.
For example: If you Like Beef Jerky, Slightly, circle 6.

REASONS FOR NOT EATING/FINISHING

Please write in the number of the MAIN REASON that you did not Eat or Finish any food.

1. Taste
2. Smell
3. Bland
4. Looks
5. Dieting
6. Full up
7. Traded
8. Saved
9. Too Cold
10. No Water
11. No Meat
12. No Time
13. Damaged
14. Frozen
15. Other

CODE	FOOD ITEM SUPPLEMENTAL PACK	AMOUNT EATEN						Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like/Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely	NOT EATEN/NOT FINISHED
101	Pouched Bread	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
102	Cold Beverage Base Powder	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
103	Hot Pepper Sauce	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
104	Charms	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
105	Beef Jerky	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____
106	Raisin Nut Trail Mix	1/4	1/2	3/4	1	2	___	1	2	3	4	5	6	7	8	9	_____

WATER CONSUMPTION

1. Please estimate the number of canteen cups of water that you consumed at different times today by writing the number of cups in the appropriate column.
For example, write in 0 1/4 1/2 3/4 1 2 3.

TIME PERIOD	NUMBER OF CANTEEN CUPS		
	Drunk as Plain Water	Drunk as Beverages eg. coffee, cocoa.	Mixed with Food
Morning	_____	_____	_____
Afternoon	_____	_____	_____
Evening	_____	_____	_____

2. What was the main source of this water ?

Melted Snow _____
Water Buffalo _____
Other Sources _____
(Please check one)

URINE

Please answer these question before going to sleep at night.

3. How LIGHT or DARK was your urine today ? Circle one number only to each question.

Extremely Light	Moderately Light	Slightly Light	Neither Light nor Dark	Slightly Dark	Moderately Dark	Extremely Dark
1	2	3	4	5	6	7

4. *Rate the color of your urine as it occurred today.*

Light Yellow	Dark Yellow	Orange	Brown
1	2	3	4

5. Did you urinate more or less often today ?

Extremely Less	Moderately Less	Slightly Less	Neither Less nor More	Slightly More	Moderately More	Extremely More
1	2	3	4	5	6	7

6. Was the amount you urinated more or less than usual ?

Extremely Less	Moderately Less	Slightly Less	Neither Less nor More	Slightly More	Moderately More	Extremely More
1	2	3	4	5	6	7

PACKAGING

7. Were any of the pouches or other packaging damaged as a result of freezing?

Please write down the name of the pouch/package. _____

_____

APPENDIX G

SAMPLE FINAL QUESTIONNAIRE

FINAL QUESTIONNAIRE

We would like to ask your final opinion about the MRE. Your opinions will be very important in determining any changes that will be made in the ration. Your answers will be kept confidential. Please answer honestly and thoughtfully. Thank you.

Proper Mark

Please indicate your study identification number. _____

DO NOT WRITE IN THIS BOX

1. What is your rank?

	1	2	3	4	5	6	7	8	9
E	○	○	○	○	○	○	○	○	○
O	○	○	○	○		○	○	○	○
WO	○	○	○	○					

2. What is your age?

- ○ under 18
- ○ 18-20
- ○ 21-25
- ○ 26-30
- ○ 31-40
- ○ 41+

3. How long have you been in the Armed Services? Fill in one answer.

- ○ 0-2 years
- ○ 3-5 years
- ○ 6-10 years
- ○ 11-15 years
- ○ 16-20 years
- ○ More than 20 years

4. What is your height?

_____FT _____IN

DO NOT WRITE IN THIS BOX

5. What is your weight? _____ lbs

DO NOT WRITE IN THIS BOX

6. What is your gender?

- ○ Male
- ○ Female

7. Were you trying to LOSE weight during this exercise? ○ YES ○ NO

8. Were you trying to GAIN weight during this exercise? ○ YES ○ NO

9. How would you describe the climate in the area that you lived in for the longest period of time in your life?

- ○ 1. hot climate (for example, Texas, Florida, Arizona)
- ○ 2. cold climate (for example, Minnesota, Alaska)
- ○ 3. mixed climate (hot summers, cold winters; for example, Massachusetts, Ohio, Iowa)
- ○ 4. temperate climate (mild weather; for example, North Carolina, Hawaii, Northern California)

10. How would you describe your level of physical activity during this exercise? Fill in the circle next to your answer.

- ○ 1. Heavy daily physical activity
- ○ 2. Moderate daily physical activity
- ○ 3. Light daily physical activity
- ○ 4. Mixed activity day-to-day

11. WHEN did you eat your MREs during this exercise? Fill in the circle next to your answer.

- ○ 1. At specific meal times (imposed by command)
- ○ 2. At specific meal times (my own choice)
- ○ 3. Throughout the day (as time permitted)
- ○ 4. Both 1 and 3
- ○ 5. Both 2 and 3

12. Overall, how often were you HUNGRY during this exercise? Fill in the circle below your answer.

NEVER HUNGRY	ALMOST NEVER HUNGRY	INFREQUENTLY HUNGRY	SOMETIMES HUNGRY	FREQUENTLY HUNGRY	ALMOST ALWAYS HUNGRY	ALWAYS HUNGRY
1	2	3	4	5	6	7
○	○	○	○	○	○	○

13. For what reason(s) did you NOT eat enough during the exercise? Fill in the circle next to ALL the reasons that apply to you. If you ALWAYS ate enough during this exercise, choose "a" only. If you choose more than one reason, mark an "X" next to the most frequent reason for not eating enough.

- ○ a. Always ate enough during this exercise.
- ○ b. Disliked the food in the MRE.
- ○ c. Not enough food in the MRE.
- ○ d. Not enough time to eat the MRE.
- ○ e. Too much trouble to eat the MRE.
- ○ f. Too cold outside to eat.

(continued on next page)

13. (continued)

- ○ g. Not enough time to heat the MRE.
- ○ h. No heat source to heat the MRE.
- ○ i. Poor heat source to heat the MRE.
- ○ j. Not enough water to prepare the MRE.
- ○ k. Got bored with the food in the MRE - not enough variety.
- ○ l. MRE packaging was damaged.
- ○ m. MRE was frozen.
- ○ n. Tried to avoid having to go to the bathroom.
- ○ o. Did not feel hungry.
- ○ p. Other (please explain) _____

14. How hungry are you RIGHT NOW? Fill in the circle below your answer.

NOT AT ALL HUNGRY	SLIGHTLY HUNGRY	SOMEWHAT HUNGRY	MODERATELY HUNGRY	VERY HUNGRY	EXTREMELY HUNGRY
1	2	3	4	5	6
○	○	○	○	○	○

15. How did you obtain water during the exercise? Fill in the circle next to all answers which apply.

- ○ a. melted snow
- ○ b. melted ice
- ○ c from an unfrozen stream
- ○ d. from an unfrozen lake or pond
- ○ e. 5 gallon cans
- ○ f. water buffalo
- ○ g. other _____

16. If you chose more than one answer in the above question (#15), which was the MOST FREQUENT way of obtaining water? Please fill in the circle under the letter from the list above.

a	b	c	d	e	f	g
○	○	○	○	○	○	○

17. How EASY or DIFFICULT was it to obtain water?

EXTREMELY DIFFICULT	MODERATELY DIFFICULT	SOMEWHAT DIFFICULT	NEITHER EASY NOR DIFFICULT	SOMEWHAT EASY	MODERATELY EASY	EXTREMELY EASY
○	○	○	○	○	○	○

18. Overall, how often were you THIRSTY during this exercise? Fill in the circle below your answer.

NEVER THIRSTY	ALMOST NEVER THIRSTY	INFREQUENTLY THIRSTY	SOMETIMES THIRSTY	FREQUENTLY THIRSTY	ALMOST ALWAYS THIRSTY	ALWAYS THIRSTY
1	2	3	4	5	6	7
○	○	○	○	○	○	○

19. For what reason(s) did you NOT drink enough during the exercise? Fill in the circle next to ALL the reasons that apply to you. If you ALWAYS drank enough during this exercise, choose "a" only. If you choose more than one reason, mark an "X" next to the most frequent reason for not drinking enough.

- a. Always drank enough during this exercise.
- b. Too much trouble to melt snow or ice.
- c. Hands got too cold while preparing water.
- d. Not enough time to melt snow or ice.
- e. Water source was too far from site.
- f. No equipment (pots, pans) to melt snow.
- g. Not enough equipment to melt snow.
- h. No heat source or stove.
- i. Not enough heat sources or stoves for the group.
- j. Water in canteen kept freezing.
- k. Not enough beverages (cocoa, coffee, etc.) in MRE.
- l. Water buffalo/water supply was empty.
- m. Tried to avoid having to go to the bathroom.
- n. Did not feel thirsty.
- o. Did not feel that I needed more water.
- p. Other (specify) _____

20. How thirsty are you RIGHT NOW? Fill in the circle below your answer.

NOT AT ALL THIRSTY	SLIGHTLY THIRSTY	SOMEWHAT THIRSTY	MODERATELY THIRSTY	VERY THIRSTY	EXTREMELY THIRSTY
○	○	○	○	○	○

21. Please rate how EASY or DIFFICULT you found each of the following aspects of preparing the MRE. Fill in the circle under one number for each aspect.

1	2	3	4	5	6	7
EXTREMELY DIFFICULT	MODERATELY DIFFICULT	SOMEWHAT DIFFICULT	NEITHER EASY NOR DIFFICULT	SOMEWHAT EASY	MODERATELY EASY	EXTREMELY EASY

	1	2	3	4	5	6	7
a. Opening the brown outer bag	○	○	○	○	○	○	○
b. Opening individual food packets	○	○	○	○	○	○	○
c. Keeping food from freezing	○	○	○	○	○	○	○
d. Eating more than one item at a time	○	○	○	○	○	○	○
e. Keeping water from freezing	○	○	○	○	○	○	○
f. Mixing water with the dry items	○	○	○	○	○	○	○
g. Heating water/beverages	○	○	○	○	○	○	○
h. Heating food	○	○	○	○	○	○	○
i. Avoiding spilling rations	○	○	○	○	○	○	○
j. Keeping hands warm while preparing and eating MRE	○	○	○	○	○	○	○

22. Please use the following scale to rate how much you like or dislike the following aspects of the MRE that you ate during this exercise.

1	2	3	4	5	6	7	8	9
DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY

	1	2	3	4	5	6	7	8	9
a. How the food tastes	○	○	○	○	○	○	○	○	○
b. How the food looks	○	○	○	○	○	○	○	○	○
c. How much food there is in one MRE (NOT including the Supplement Pack)	○	○	○	○	○	○	○	○	○
d. How much food there is in one MRE (including the Supplement Pack)	○	○	○	○	○	○	○	○	○
e. How much variety there is - meal to meal	○	○	○	○	○	○	○	○	○
f. Eating the MRE for breakfast	○	○	○	○	○	○	○	○	○
g. Eating the MRE for lunch	○	○	○	○	○	○	○	○	○
h. Eating the MRE for dinner	○	○	○	○	○	○	○	○	○

23. What did you usually wear on your hands while preparing and eating the MRE outside?

- ○ a. did not eat outside (skip to question #25)
- ○ b. wool mitten insert with trigger finger
- ○ c. wool glove insert
- ○ d. black leather outer glove
- ○ e. Arctic Mitten
- ○ f. nothing
- ○ g. other (specify) _____

24. How cold did your hands get while preparing or eating the MRE outside?

NOT AT ALL COLD	SLIGHTLY COLD	SOMEWHAT COLD	MODERATELY COLD	VERY COLD	EXTREMELY COLD
1	2	3	4	5	6
○	○	○	○	○	○

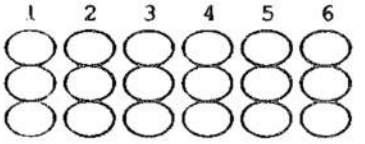
25. How often did the following problems occur during the field exercise? Fill in the circle under one number for each item.

NEVER	ONCE	A FEW TIMES	ABOUT EVERY OTHER DAY	DAILY	MORE THAN ONCE A DAY
1	2	3	4	5	6

	1	2	3	4	5	6
a the food in the MRE froze	○	○	○	○	○	○
b. the water in the canteen froze	○	○	○	○	○	○
c. the MRE brown outer bag was torn or damaged	○	○	○	○	○	○
d. the individual food packets were torn or damaged	○	○	○	○	○	○

26. How often did you HEAT each of the following items during the field exercise?

NEVER	ONCE	A FEW TIMES	ABOUT EVERY OTHER DAY	DAILY	MORE THAN ONCE A DAY
1	2	3	4	5	6



a. the food in the MRE
b. water for beverages
c. water for washing

27. During this exercise, what type of HEAT SOURCE did you use to heat water and/or the MRE? Please fill in the circle next to all that apply.

- ○ a. did not heat water or rations in the field
- ○ b. squad stove
- ○ c. yukon stove
- ○ d. mounted vehicle heater
- ○ e. sterno
- ○ f. heat tabs
- ○ g. canteen cup stand and heat tabs
- ○ h. heater pads
- ○ i. other (specify) _____

_____

28. If you heated your MREs and/or water using MORE THAN ONE method, what was the most frequent method that you used? Please fill in the circle under the letter from the list above.

a	b	c	d	e	f	g	h	i
○	○	○	○	○	○	○	○	○

29. How important do you think it is to include a heating system with the MRE?

EXTREMELY UNIMPORTANT	MODERATELY UNIMPORTANT	SLIGHTLY UNIMPORTANT	NEITHER UNIMPORTANT NOR IMPORTANT	SLIGHTLY IMPORTANT	MODERATELY IMPORTANT	EXTREMELY IMPORTANT
1	2	3	4	5	6	7
○	○	○	○	○	○	○

30. We would like your honest evaluation of the MRE items you ate. Using the following scale, please fill in the circle below the number that best describes your opinion of each item. For items that you did not try during this exercise, fill in the circle under "0"

NEVER TRIED	DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
0	1	2	3	4	5	6	7	8	9

		0	1	2	3	4	5	6	7	8	9
1.	Beef w/ Barbecue Sauce	○	○	○	○	○	○	○	○	○	○
2.	Beef w/ Gravy	○	○	○	○	○	○	○	○	○	○
3.	Beef w/ Spiced Sauce	○	○	○	○	○	○	○	○	○	○
4.	Beef Steak	○	○	○	○	○	○	○	○	○	○
5.	Beef Patties	○	○	○	○	○	○	○	○	○	○
6.	Beef Stew	○	○	○	○	○	○	○	○	○	○
7.	Chicken a la King	○	○	○	○	○	○	○	○	○	○
8.	Frankfurters	○	○	○	○	○	○	○	○	○	○
9.	Chicken Loaf	○	○	○	○	○	○	○	○	○	○
10.	Ham/Chicken Loaf	○	○	○	○	○	○	○	○	○	○
11.	Ham Slices	○	○	○	○	○	○	○	○	○	○
12.	Meatballs w/ Barbecue Sauce	○	○	○	○	○	○	○	○	○	○
13.	Pork Sausage Patties	○	○	○	○	○	○	○	○	○	○
14.	Turkey w/ gravy	○	○	○	○	○	○	○	○	○	○
15.	Crackers	○	○	○	○	○	○	○	○	○	○
16.	Beans w/ Tomato Sauce	○	○	○	○	○	○	○	○	○	○
17.	Potato Patty	○	○	○	○	○	○	○	○	○	○
18.	Cheese	○	○	○	○	○	○	○	○	○	○
19.	Peanut Butter	○	○	○	○	○	○	○	○	○	○
20.	Jelly	○	○	○	○	○	○	○	○	○	○
21.	Applesauce	○	○	○	○	○	○	○	○	○	○
22.	Fruit Mix	○	○	○	○	○	○	○	○	○	○
23.	Peaches	○	○	○	○	○	○	○	○	○	○
24.	Strawberries	○	○	○	○	○	○	○	○	○	○
25.	Pears	○	○	○	○	○	○	○	○	○	○
26.	Pineapple	○	○	○	○	○	○	○	○	○	○
27.	Brownie	○	○	○	○	○	○	○	○	○	○
28.	Cherry Nut Cake	○	○	○	○	○	○	○	○	○	○
29.	Chocolate Covered Cookie	○	○	○	○	○	○	○	○	○	○
30.	Fruitcake	○	○	○	○	○	○	○	○	○	○

(Continued on next page)

(Continued)

NEVER TRIED	DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
0	1	2	3	4	5	6	7	8	9

	0	1	2	3	4	5	6	7	8	9
31. Maple Nut Cake	○	○	○	○	○	○	○	○	○	○
32. Orange Nut Cake	○	○	○	○	○	○	○	○	○	○
33. Chocolate Nut Cake	○	○	○	○	○	○	○	○	○	○
34. Pineapple Nut Cake	○	○	○	○	○	○	○	○	○	○
35. Cocoa	○	○	○	○	○	○	○	○	○	○
36. Coffee	○	○	○	○	○	○	○	○	○	○
37. Cream Substitute	○	○	○	○	○	○	○	○	○	○
38. Catsup	○	○	○	○	○	○	○	○	○	○
39. Soup/Gravy Base	○	○	○	○	○	○	○	○	○	○
40. Chocolate Fudge Bar	○	○	○	○	○	○	○	○	○	○
41. Chocolate Covered Coconut Bar										
42. Caramel	○	○	○	○	○	○	○	○	○	○
43. Vanilla Fudge	○	○	○	○	○	○	○	○	○	○
44. Starch Jelly Bar	○	○	○	○	○	○	○	○	○	○
45. Chocolate Toffee Bar	○	○	○	○	○	○	○	○	○	○
46. Chocolate Almond Bar	○	○	○	○	○	○	○	○	○	○
47. Additional Items _____	○	○	○	○	○	○	○	○	○	○
48. _____										
49. _____	○	○	○	○	○	○	○	○	○	○

31. Please use the scale below to rate the PORTION SIZE of the following items.

PORTION SIZE IS:

MUCH TOO SMALL	MODERATELY TOO SMALL	SLIGHTLY TOO SMALL	JUST RIGHT	SLIGHTLY TOO LARGE	MODERATELY TOO LARGE	MUCH TOO LARGE
1	2	3	4	5	6	7

PORTION SIZE IS:

	1	2	3	4	5	6	7
a. entrees (main course)	○	○	○	○	○	○	○
b. starches (potatoes, crackers)	○	○	○	○	○	○	○
c. fruits	○	○	○	○	○	○	○
d. desserts (cakes, brownie)	○	○	○	○	○	○	○
e. candy	○	○	○	○	○	○	○
f. cold beverage powders	○	○	○	○	○	○	○
g. hot beverage powders	○	○	○	○	○	○	○
h. non-sweet snacks	○	○	○	○	○	○	○
i. seasonings (salt, hot sauce)	○	○	○	○	○	○	○

32. Did you consume any foods or beverages during this exercise that were NOT MRE items? Please be honest.

YES ◯ NO ◯

If yes, what did you eat and/or drink and how often?

33. Are there any items that you would like to see ADDED to the MRE that you ate during this exercise?

34. Are there any items that you would like to see DROPPED from the MRE?

35. What did you like most about the MRE?

36. What did you like least about the MRE?

37. Please use this space for any other comments you have about the MRE.

THE FOLLOWING QUESTIONS REFER TO THE SUPPLEMENT PACK THAT WAS INCLUDED WITH YOUR MRE. YOUR ANSWERS TO THESE QUESTIONS WILL HELP DETERMINE IF THE SUPPLEMENT PACK WILL BE STANDARD ISSUE IN THE FUTURE.

38. WHEN did you eat the following items from the MRE Supplement Pack?

	NEVER	WITH BREAKFAST	WITH LUNCH	WITH DINNER	WITH OR AS A SNACK
a. pouched bread	○	○	○	○	○
b. cold beverage base powder	○	○	○	○	○
c. hot pepper sauce	○	○	○	○	○
d. charms	○	○	○	○	○
e. beef jerky	○	○	○	○	○
f. raisin nut trail mix	○	○	○	○	○

39. How OFTEN did the following problems occur with the Supplement Pack?

NEVER	ONCE	A FEW TIMES	ABOUT EVERY OTHER DAY	DAILY	MORE THAN ONCE A DAY
1	2	3	4	5	6

	1	2	3	4	5	6
a. the food was frozen	○	○	○	○	○	○
b. the outer bag was torn or damaged	○	○	○	○	○	○
c. the individual food packets were torn or damaged	○	○	○	○	○	○

40. Using the following scale, please fill in the circle below the number that best describes your opinion of each MRE supplement item.

NEVER TRIED	DISLIKE EXTREMELY	DISLIKE VERY MUCH	DISLIKE MODERATELY	DISLIKE SLIGHTLY	NEITHER LIKE NOR DISLIKE	LIKE SLIGHTLY	LIKE MODERATELY	LIKE VERY MUCH	LIKE EXTREMELY
0	1	2	3	4	5	6	7	8	9

	0	1	2	3	4	5	6	7	8	9
a. pouched bread	○	○	○	○	○	○	○	○	○	○
b. cold beverage base powder	○	○	○	○	○	○	○	○	○	○
c. hot pepper sauce	○	○	○	○	○	○	○	○	○	○
d. charms	○	○	○	○	○	○	○	○	○	○
e. beef jerky	○	○	○	○	○	○	○	○	○	○
f. raisin nut trail mix	○	○	○	○	○	○	○	○	○	○

41. Please use the following scale to rate the PORTION SIZE of the Supplement items.
PORTION SIZE IS:

MUCH TOO SMALL	MODERATELY TOO SMALL	SLIGHTLY TOO SMALL	JUST RIGHT	SLIGHTLY TOO LARGE	MODERATELY TOO LARGE	MUCH TOO LARGE
1	2	3	4	5	6	7

	1	2	3	4	5	6	7
a. pouched bread	○	○	○	○	○	○	○
b. cold beverage base powder	○	○	○	○	○	○	○
c. hot pepper sauce	○	○	○	○	○	○	○
d. charms	○	○	○	○	○	○	○
e. beef jerky	○	○	○	○	○	○	○
f. raisin nut trail mix	○	○	○	○	○	○	○

42. How important do you think it is to include the Supplement Pack with the MRE?

EXTREMELY UNIMPORTANT	MODERATELY UNIMPORTANT	SLIGHTLY UNIMPORTANT	NEITHER UNIMPORTANT NOR IMPORTANT	SLIGHTLY IMPORTANT	MODERATELY IMPORTANT	EXTREMELY IMPORTANT
1	2	3	4	5	6	7
○	○	○	○	○	○	○

43. Which items (if any) do you think should be dropped from the Supplement Pack, and which items do you think should be included with some or all of the MREs?

	DROP	ADD TO SOME MRE MEALS	ADD TO MOST MRE MEALS	ADD TO ALL MRE MEALS
a. pouched bread	○	○	○	○
b. cold beverage base powder	○	○	○	○
c. hot pepper sauce	○	○	○	○
d. charms	○	○	○	○
e. beef jerky	○	○	○	○
f. raisin nut trail mix	○	○	○	○

44. Are there any items that you would like to see ADDED to the Supplement Pack? Please be realistic.

45. What did you like most about the MRE Supplement Pack?

46. What did you like least about the MRE Supplement Pack?

47. Are there any other comments or suggestions you would like to make about the Supplement Pack?

48. Please use this space for any other general comments you may have.

APPENDIX H

ACCEPTABILITY RESULTS FROM THE FIELD

Table H 1. Mean Hedonic Ratings From the Field* MRE VI - Control vs. Supplemented Groups.

	MRE VI	MRE VI Plus	t-Test Results
BEEF WITH BBQ SAUCE	7.58 (.33)**	6.00 (1.0)	NS
BEEF WITH GRAVY	5.21 (.45)	5.96 (.45)	NS
BEEF WITH SPICED SAUCE	5.30 (.48)	5.63 (.58)	NS
BEEF PATTIES	6.51 (.44)	6.83 (.44)	NS
BEEF STEW	6.67 (.32)	7.37 (.24)	NS
CHICKEN ALA KING	6.15 (.40)	6.99 (.30)	NS
FRANKFURTERS	6.93 (.26)	7.21 (.33)	NS
HAM/CHICKEN LOAF	5.67 (.54)	5.79 (.46)	NS
HAM SLICES	6.91 (.33)	7.75 (.39)	NS
MEATBALLS WITH BBQ SAUCE	5.88 (.59)	6.38 (.94)	NS
PORK SAUSAGE PATTIES	6.34 (.41)	6.45 (.46)	NS
TURKEY WITH GRAVY	5.33 (1.0)	6.75 (1.0)	NS
CRACKERS	6.71 (.23)	7.19 (.24)	NS
BEANS WITH TOMATO SAUCE	5.88 (.40)	6.08 (.41)	NS
CHEESE SPREAD	6.79 (.28)	7.30 (.29)	NS
PEANUT BUTTER	7.02 (.26)	7.12 (.33)	NS
JELLY	6.53 (.25)	7.22 (.35)	NS
APPLESAUCE	7.58 (.29)	7.71 (.30)	NS
FRUIT MIX	6.47 (.33)	6.45 (.43)	NS
PEACHES	6.05 (.43)	6.49 (.52)	NS
PEARS	7.27 (.27)	7.87 (.30)	NS
BROWNIE	6.34 (.39)	6.51 (.38)	NS
CHERRY NUT CAKE	5.60 (.59)	5.98 (.56)	NS
CHOC. COVERED COOKIE	7.57 (.24)	7.91 (.20)	NS
FRUITCAKE	5.09 (.55)	4.62 (.76)	NS
MAPLE NUT CAKE	5.25 (1.9)	7.00 (1.1)	NS
ORANGE NUT CAKE	5.61 (.61)	4.67 (.82)	NS
COCOA	7.68 (.24)	7.98 (.23)	NS
COFFEE	7.29 (.28)	7.26 (.36)	NS
CREAM SUBSTITUTE	7.06 (.43)	7.67 (.32)	NS
CATSUP	5.83 (.49)	5.98 (.71)	NS
SOUP/GRAVY BASE	6.86 (.66)	4.80 (1.2)	NS
SUGAR	7.33 (.28)	7.67 (.34)	NS
SALT	6.36 (.33)	5.62 (.62)	NS
CHOCOLATE FUDGE BAR	6.92 (.45)	7.23 (.38)	NS
CARAMEL	7.55 (.33)	8.23 (.32)	NS
VANILLA FUDGE	5.50 (1.5)	6.80 (.80)	NS
CHOCOLATE TOFFEE BAR	8.20 (.37)	6.86 (.77)	NS
CHOCOLATE ALMOND BAR	6.21 (1.0)	8.50 (.29)	NS
GUM	7.57 (.26)	7.63 (.40)	NS

* Rating Scale: 1 = Dislike Extremely ... 5 = Neither Like Nor Dislike ... 9 = Like Extremely

** Numbers in parentheses are standard errors.

Table H 2. Mean Hedonic Ratings From the Field*
MRE VIII - Control vs. Supplemented Groups.

	MRE VI	MRE VI Plus	t-Test Results
PORK W/ RICE & BBQ SAUCE	7.11 (.33)**	8.14 (.23)	t = -2.63, p < 0.05
CORNED BEEF HASH	7.25 (.30)	7.84 (.20)	NS
CHICKEN STEW	6.91 (.37)	7.68 (.21)	NS
OMELET WITH HAM	7.26 (.33)	7.91 (.18)	NS
SPAGHETTI W/ MEAT SAUCE	7.66 (.20)	8.37 (.15)	t = -2.85, p < 0.01
CHICKEN ALA KING	6.59 (.34)	7.01 (.38)	NS
BEEF STEW	7.27 (.29)	7.70 (.31)	NS
HAM SLICE	7.25 (.26)	7.80 (.28)	NS
MEATBALLS W/RICE & SAUCE	6.76 (.40)	7.96 (.23)	t = -2.63, p = 0.05
TUNA WITH NOODLES	6.97 (.42)	8.29 (.17)	t = -2.90, p < 0.01
CHICKEN AND RICE	7.23 (.31)	8.44 (.13)	t = -3.64, p = 0.001
ESCALLOPED POTATOES W/HAM	7.72 (.21)	8.25 (.17)	NS
CRACKERS	7.62 (.17)	7.84 (.19)	NS
POTATOES AU GRATIN	7.31 (.32)	7.81 (.24)	NS
CHEESE SPREAD	7.62 (.19)	8.20 (.13)	t = -2.45, p < 0.05
JELLY	7.61 (.22)	8.03 (.16)	NS
PEANUT BUTTER	7.33 (.23)	7.60 (.34)	NS
APPLESAUCE	7.86 (.23)	8.37 (.13)	NS
FRUIT MIX	6.80 (.32)	7.62 (.31)	NS
PEACHES	6.73 (.57)	7.68 (.37)	NS
PEARS	7.28 (.29)	7.23 (.44)	NS
STRAWBERRIES	8.03 (.25)	8.33 (.41)	NS
BROWNIE	6.14 (.47)	7.15 (.34)	NS
CHERRY NUT CAKE	7.25 (.37)	7.87 (.35)	NS
CHOC. COVERED COOKIE	7.80 (.25)	8.54 (.18)	t = -2.40, p < 0.05
MAPLE NUT CAKE	6.66 (.50)	7.01 (.53)	NS
OATMEAL COOKIE BAR	7.27 (.34)	8.16 (.31)	NS
CHOCOLATE NUT CAKE	7.87 (.27)	8.72 (.09)	t = -2.98, p < 0.01
FRUIT FLAVORED BEVERAGE	7.82 (.18)	8.34 (.14)	t = -2.28, p < 0.05
COCOA	7.97 (.16)	8.33 (.17)	NS
COFFEE	7.54 (.53)	7.34 (.50)	NS
TOOTSIE ROLL	8.56 (.24)	7.90 (.87)	NS
CHARMS	7.94 (.19)	8.65 (.14)	t = -3.12, p < 0.01
M & M'S	8.61 (.11)	8.76 (.15)	NS
CARAMEL	8.15 (.21)	8.60 (.15)	NS
GUM	7.80 (.22)	8.37 (.15)	t = -2.15, p < 0.05
HOT SAUCE	7.39 (.25)	7.88 (.36)	NS
CREAM SUBSTITUTE	7.60 (.38)	7.67 (.44)	NS
SUGAR	7.84 (.38)	7.78 (.38)	NS
SALT	6.89 (.38)	6.75 (.70)	NS

* Rating Scale: 1 = Dislike Extremely ... 5 = Neither Like Nor Dislike ... 9 = Like Extremely
** Numbers in parentheses are standard errors.

Table H 3. Mean Hedonic Ratings of the Supplemental Pack Items*
Field Ratings - MRE VI Group vs. MRE VIII Group.

	MRE VI	MRE VI Plus	t-Test Results
Pouched Bread	8.32 (.15)**	8.75 (.06)	t = -2.65, p < 0.05
Cold Beverage Powder	8.15 (.16)	8.44 (.11)	NS
Hot Pepper Sauce	7.18 (.55)	7.51 (.43)	NS
Charms	8.35 (.14)	8.67 (.12)	NS
Beef Jerky	8.30 (.16)	8.86 (.05)	t = -3.40, p < 0.01
Raisin Nut Trail Mix	8.43 (.14)	8.36 (.14)	NS

* Rating Scale: 1 = Dislike Extremely ... 5 = Neither Like Nor Dislike ... 9 = Like Extremely

** Numbers in parentheses are standard errors.

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